IMPERIAL BUREAU OF ANIMAL HEALTH

THE

VETERINARY BULLETIN

Vol. 2.] **March, 1932.** [No. 3.

DISEASES CAUSED BY BACTERIA AND FUNGI.

EBERSON, F., & SWEENEY, M. A. (1931). **Tinctorial Transmutations of Acid-Fast Micro-Organisms and Virulence of Tubercle Bacilli.**—*J. Infect. Dis* **49.** 303-317. 5 tables. [9 refs.]

Cultivation of an avirulent strain of the tubercle bacillus on a simple non-protein medium caused the disappearance of acid-fastness after a number of generations. Occasionally, a partial reversion took place when both acid-fast and non-acid-fast forms were apparent. Further study on the effect of incorporating various dyes in the media was carried out with this strain. It was found that acid fuchsin and basic fuchsin favoured the growth of acid-fast organisms; neutral fuchsin favoured the development of non-acid-fast forms, whilst an addition of methylene blue led to the production of mixtures. A virulent strain of the tubercle bacillus failed to grow in concentrations of the dyes (1 in 1,000 to 1 in 100,000) in which the avirulent strain had grown readily. Lipoid or fatty substances in culture media failed to transform non-acid-fast bacteria into acid-fast types.

The avirulent, non-acid-fast strain failed to immunise guinea pigs against the virulent strain; it appeared to be devoid of invasive power and lacked the power of producing an allergic condition in guinea pigs.

R. LOVELL.

FLÜCKIGER, G. (1931). Ueber die kulturelle Differenzierung der Tuberkelbazillen. **[On the Cultural Differentiation of Tubercle Bacilli].**—*Schweiz. Arch. Tierhlk.* **73.** 364-371. 1 coloured plate. [3 refs.]

The author describes the results he obtained in the differentiation of human, bovine and avian tubercle bacilli by the cultural methods reported on by WOLTERS and DEHMEL [(1930). *Zlb. Bakt. I.* (*Orig.*). **117.** 279-283, 412-419].

He found that Petragnani's medium, which consists of milk to which potato meal and eggs have been added, and Besredka's broth, which consists of egg yolk diluted with soda solution, were useful for the differentiation of the avian type from the bovine and human types, but that they were less useful in differentiating between the bovine and human types.

A good illustration of the respective growths of these bacteria is given on a coloured plate.

The author discusses the various culture media which have been recommended from time to time for the growth of *B. tuberculosis*. He considers that progress has been made in the differentiation of the types by means which eliminate the use of biological tests.

J. T. E.

I. Fejgin, B. (1931). Sur quelques souches issues des éléments filtrables du Bacille tuberculeux. [**Some Cultures derived from the Filtrable Elements of the Tubercle Bacillus**].—*C.R. Soc. Biol. Paris.* **106.** 163-165. [5 refs.]

IIa. Aubertin, E., & Reynes, V. (1931). Sur la mise en évidence, par inoculations dans les ganglions lymphatiques du Cobaye, de virus filtrant tuberculeux provenant de crachats bacillifères. [**Evidence of the Presence of a Filtrable Form of the Tubercle Bacillus in Tuberculous Sputa, as shown by Intra-Lymphatic Gland Inoculations in Guinea Pigs**].—*Ibid.* 1161-1163. [1 ref.]

IIb. Aubertin, E., & Reynes, V. (1931). Lesions tuberculeuses produites par le virus filtrant provenant de crachats bacillifères et transmis de ganglion à ganglion chez le Cobaye. L'ultravirus tuberculeux récupère-t-il un pouvoir pathogène analogue à celui du Bacille de Koch ordinaire ? [**Tuberculous Lesions produced by the Filtrable Virus obtained from Tuberculous Sputa and transmitted in Guinea Pigs by Gland to Gland Inoculations. Does the Ultravirus recover a Pathogenicity analogous to that of Normal Tubercle Bacilli ?**].—*Ibid.* 1163-1166. [1 ref.]

IIc. Aubertin, E., & Reynes, V. (1931). Résultats d'ensemble de plusieurs séries de recherches sur le pouvoir pathogène de l'ultravirus tuberculeux transmis de ganglions à ganglions chez le Cobaye. [**The Combined Results of a Number of Investigations regarding the Pathogenic Power of the Tubercle Bacillus Ultravirus transmitted by Gland to Gland Inoculation in Guinea Pigs**].—*Ibid.* **107.** 354-357. [1 ref.]

IId. Aubertin, E., & Reynes, V. (1931). Sur la mise en évidence du pouvoir caséogène de l'ultravirus tuberculeux par transmission de ganglions â ganglions chez le Cobaye. Forme caséeuse abortive produite par ce virus. [**Evidence of the Caseating Power of the Ultravirus of the Tubercle Bacillus as shown by Gland to Gland Inoculations in the Guinea Pig. The Abortive Caseous Lesions produced by this Virus**].—*Ibid.* 350-353. [2 refs.]

III. Ninni, C. (1931). Sur la technique à employer pour obtenir des filtrats contenant des éléments filtrables du virus tuberculeux. [**The Technique of obtaining Filtrates containing the Filtrable Virus of the Tubercle Bacillus**]. —*Ann. Inst. Pasteur.* **46.** 598-603. [10 refs.]

IV. Nègre, L., & Valtis, J. (1931). Action des extraits acétoniques de bacilles de Koch sur les propriétés pathogènes des éléments filtrables du virus tuberculeux. [**The Action of Acetone Extracts of the Tubercle Bacillus on the Pathogenic Properties of the Filtrable Virus of this Organism**].—*Ibid.* 587-597.

I. The author has attempted to grow the tubercle bacillus *in vitro* from filtrates of tuberculous tissues and of tubercle bacilli cultivated on various media. One culture was obtained from tissue filtrates, and two from culture filtrates, in fluid media. These cultures proved to be made up of granular bodies and

filamentous structures containing acid-fast elements ; sub-culture was found possible. The virulence of these cultures for the guinea pig was very low and was not augmented by passage.

II. These papers describe a number of experiments carried out to demonstrate the presence of a filtrable form of the tubercle bacillus in tuberculous sputa, and to investigate the possibilities of exhalting its virulence by gland to gland serial inoculations in guinea pigs.

By this inoculation method, the authors not only obtained the common glandular enlargement lesions containing a few demonstrable acid-fast organisms, but also lesions simulating those caused by ordinary tubercle bacilli—ulceration at the site of inoculation, cachexia, caseation, tuberculous nodules—and an abortive caseation in which no acid-fast organisms could be found, the tendency being for it to regress and disappear on passage. They consider that these results were due to the mode of inoculation. In view of the variable results obtained with the same material in different guinea pigs and the fact that serial inoculations resulted in alternating phases of augmented and diminished virulence, they do not consider it justifiable to assume that the pathogenic powers of the filtrable virus and the bacillary form are the same.

III. In attempting to obtain filtrable forms of the tubercle bacillus from cultures, adherence to certain essential details is necessary if failures are to be avoided. The strain to be filtered must first be adapted to some medium on which a rapid growth is obtained ; a young culture should be used and emulsified by agitation for 10-15 minutes with glass beads and sand. It is best to dilute the emulsion and to keep it in cold-storage for two to three days prior to filtration ; putrefactive changes are deleterious to the virus.

The filtration must be rapid, and a preliminary filtration through paper is advisable, for any blocking of the filter will hold back the virus which appears to be of comparatively large molecular size.

IV. Acetone extracts of killed tubercle bacilli, when inoculated at bi-weekly intervals into guinea pigs treated with filtrates of tubercle bacilli, appeared to activate the virus so that, after 14 injections, it was possible to obtain lesions of generalised tuberculosis in second passage experiments. Control guinea pigs and guinea pigs inoculated with paratubercle acetone extracts or olive oil were not affected.

The authors describe a case of pyopneumothorax in which this acetone extract method enabled them to demonstrate the filtrable tubercle virus where other methods failed.

NORMAN HOLE.

RICE, C. E. (1931). **Studies in the Variability of Tubercle Bacilli. IV. Antigenic Properties of S and R Cultures.**—*Can. J. Res.* **5.** 375-388. 9 tables, 1 fig. [27 refs.]

This paper is concerned with the antigenic behaviour of certain typical S and R cultures of tubercle bacilli. Ordinary serological procedures have not, to date, been as successful as cultural methods and animal inoculation in the differentiation of types of tubercle bacilli and other acid-fast species. The author has endeavoured to demonstrate the existence of differences in antigenic activity between the virulent and avirulent S and R types of tubercle bacilli by means of a quantitative technique in which the amount of complement reacting with a sensitised antigen is measured.

The preparation both of immune serum in rabbits and of the antigens used is first described. The results of experiments indicate the existence in an S and R antiserum of three types of antibodies :—(a) an antibody specific for the type only; (b) a species antibody; and (c) a group antigen. The percentage in which each antibody is present is calculated and it appears that, in the change from S to R, there is a substitution of species-specific factors for type-specific groups. Bovine and human strains seem to elicit the same type species antibodies, but those of the avian strains are different.

Experiments carried out with two S and R strains of BCG showed differences which suggested the possibility that these organisms are low in antigenic structure.

Extracts of *Myco. leprae* and of Petroff's avian strains of the tubercle bacillus behaved in a similar manner, the S extracts being always definitely inferior to the R extracts in their antigenic activities.

N. BARRON.

PRICKETT, P. S., & MASSENGALE, O. N. (1931). **Mycobacterium. Ergosterol Content of Certain Species and Effect of Ergosterol on their Growth.**—*J. Infect. Dis.* **49.** 297-302. [11 refs.]

Nine cultures, representing six different species of mycobacterium, were found to contain no ergosterol when grown on 5 per cent. glycerol nutrient agar. This result was unexpected as ergosterol is so common in fungi and mycobacterium possesses much fat. The ergosterol was detected by ultra-violet absorption tests after suitable chemical treatment of the medium. Growth appeared to be stimulated by the addition of unactivated ergosterol, whilst the activated substance either had no effect or else exerted a retarding effect. Both substances stimulated pigment production.

The retarding effect of the activated ergosterol on growth appeared greater with pathogenic strains of *Myco. tuberculosis*, both human and bovine, than with the corresponding non-pathogenic organisms.

W. R. WOOLDRIDGE.

NINNI, C. (1931). L'ultravirus dans les produits tuberculeux ; son rapport avec l'état de l'infection. **[The Filtrable Virus in Tuberculous Products ; its Bearing on the State of Infection].**—*C.R. Soc. Biol. Paris.* **107.** 17-20. [1 ref.]

The author filtered 44 samples of tuberculous products and inoculated the filtrates into the cervical glands of guinea pigs, passage from guinea pig to guinea pig being carried out in some cases. He considers from his findings that there is a direct association between the number of acid-fast bacilli found in the pathological specimen and the number of actual bacteria found in the gland of the inoculated guinea pig, also that an association exists between acute infection of the guinea pig and the abundance of filtrable forms of bacilli.

[Unfortunately no details are given to show whether the filtration experiments were in any way controlled. Brief instructions only are given and no control guinea pigs were used.]

R. LOVELL.

SAENZ, A. (1931). Valeur diagnostique de l'hémoculture chez les tuberculeux. **[The Value of Blood Cultures in the Diagnosis of Tuberculosis].**—*C.R. Soc. Biol. Paris.* **107.** 1455-1457.

The author has examined samples of blood from sick persons—some of whom were affected with tuberculosis and some with other diseases—according to the technique devised by LÖWENSTEIN for the isolation of the tubercle bacillus from the blood stream. Each specimen was distributed over six tubes of the medium : if macroscopic colonies failed to develop, preparations from the surface were examined microscopically after one, three, five and twelve weeks respectively.

In 18 samples out of 300 examined, cultures of acid-fast organisms were obtained, but in certain instances microscopic colonies were not discovered until the 60th day after inoculation. Up to the present, the author has identified one strain of a paratubercle bacillus, one avian strain from a case of lupus and several mammalian strains from cases of tuberculosis of the bones or lungs.

It is considered that the medium of LÖWENSTEIN does not present any particular advantage over other types of egg media ; in fact, it has the drawback that it favours the growth of secondary organisms which are occasionally present in the blood stream. On the other hand, the preparation of the seed material is of the utmost importance as successful results cannot be obtained unless the technique suggested by LÖWENSTEIN is very carefully followed, particularly as regards the elimination of all traces of hæmoglobin by repeated washing of the centrifuged deposits.

R. E. GLOVER.

HOLLANDE, A. Ch., & PENN, J. (1931). Tératocytes ; cellules â noyaux monstreux, observées dans le poumon des Cobayes et des Lapins tuberculeux. **[Teratocytes ; Cells with very large Nuclei, seen in the Lungs of Tuberculous Guinea Pigs and Rabbits.]**—*C.R. Soc. Biol. Paris.* **107.** 143-146. 12 figs. [2 refs.]

The authors observed, in the blood capillaries of the lungs of tuberculous rabbits and guinea pigs, a type of cell which they believe has not previously been described and they propose that it should be called a " teratocyte." The cell is described as being very variable in shape and size, but characterised by a large nucleus which may appear as a lobulated structure with a corrugated outline, as a ribbon which turns and twists in itself, or as strands of nuclear chromatin. It is considered that these cells are abnormal monocytes, hypertrophied under the influence of the toxins of the tubercle bacillus and similar to those which have previously been described by the authors in the blood of insects as a result of the action of certain parasites.

R. LOVELL.

VERGE, J. (1931). Une nouvelle méthode de tuberculination : l'intradermo-tuberculination seconde. **[A New Tuberculin Test : the Double Intradermal Method].**—*Rev. gén. Méd. vét.* **40.** 1-7. 2 tables. [16 refs.]

A concise review of the technique and interpretation of the double intradermal tuberculin test. While admitting certain of the advantages which are claimed for this method, the author suggests that the test, in addition to the drawback of greater complexity as compared with the single intradermal inoculation test, does not seem to afford a commensurate increase in reliability since doubtful reactions are not entirely eliminated.

R. E. GLOVER.

LESLIE, P. H., & SHERA, A. G. (1931). **A New Serological Type of Salmonella.** —*J. Path. Bact.* **34.** 533-537. 5 tables. [4 refs.]

The organism described was isolated from the blood of a human patient suffering from a clinically typical attack of paratyphoid fever. Antigenic analysis revealed it to be a diphasic member of the Salmonella group. Its specific, heat-labile, flagellar antigen is closely related to the Newport and Reading types, and, in a lesser degree, to *S. abortus equi*, whilst the group antigen is almost identical with the Reading-suipestifer-paratyphoid C sub-group. The " O " heat-stable somatic antigen is identical with that of *S. enteritidis*, *S. sanguinarum* and *S. typhosus*. Its antigenic structure, expressed in the symbols used by WHITE [(1926) *Spec. Rep. Ser. Med. Res. Council, Gt. Britain.* No. 103.] is as follows :—

Specific phase = D1 D2 and a minor factor.
Group phase = G. E1 E2 and minor factors.
" O " antigen = III.

The authors propose that the type be called *Salmonella eastbourne*.

[The interest to veterinarians lies in the fact that many bacteria of the Salmonella group are known to be pathogenic to animals and that *S. eastbourne* shares certain antigens with various animal pathogens. *S. enteritidis*, *S. dublin*, *S. pullorum* and *S. sanguinarium*, which are known pathogens of animals and birds, all possess a similar " O " somatic antigen to that of *S. eastbourne*, which is also allied in its heat-labile flagellar antigens to *S. abortus equi*, *S. abortus ovis*, *S. suipestifer*, *S. ærtrycke* and several other species pathogenic to domesticated animals.]

R. LOVELL.

BRUNETT, E. L. (1931). **Paratyphoid Infection of Pigeons.**—*Rep. New York State Vet. Coll. for 1929-30.* 89-93. 1 table. [3 refs.]

The author reports an infection due to an ærtrycke type of paratyphoid organism which affected 5 to 6 per cent. of a flock of 8,000 pigeons. The affected birds lost the proper use of their wings and examination showed the presence of soft swellings in the neighbourhood of the joints, but usually independent of the joint cavity ; these swellings consisted of a cyst containing straw-coloured viscid material from which the bacillus was readily cultivated. Ovarian lesions resembling those of *B. pullorum* in the fowl, were also noted and yielded cultures of the same organism. Biochemical and serological examinations showed the bacillus to be closely allied to *B. anatum* (ærtrycke type). Antibodies were present in the serum of infected birds. The disease was reproduced experimentally in pigeons, but the organism was of low pathogenicity for the fowl.

In conclusion, the author suggests the possibility of egg transmission and compares the disease with pullorum disease.

NORMAN HOLE.

ANDERSON, J. S., HAPPOLD, F. C., MCLEOD, J. W., & THOMSON, J. G. (1931). **On the Existence of Two Forms of Diphtheria Bacillus**—*B. diphtheriae gravis* **and** *B. diphtheriae mitis*—**and a New Medium for their Differentiation and for the Bacteriological Diagnosis of Diphtheria.**—*J. Path. Bact.* **34.** 667-681. 1 coloured plate, 7 tables. [38 refs.]

A review of the literature shows a striking contrast between the optimism which reigned until 1927 with regard to the successful medical control of diphtheria and the perplexity which has been expressed in many parts of Europe since that date.

During the last eight years, routine examinations at Leeds have suggested that two distinct cultural forms of the diphtheria bacillus exist and, with the more recent improvement in methods, it has been possible to establish a correlation between one form, *B. diphtheriae gravis* and the graver cases which are intractable to serum treatment. Of 104 cases in which clinical and bacteriological data were compared, 63 yielded cultures of *gravis* and 35 cultures of *mitis*, whilst six cases gave intermediate forms.

B. diphtheriae gravis is distinguished from *B. diphtheriae mitis* by the following characters :—(1) the colony is flattened, lustreless and like *B. xerosis*, but heavier ; (2) on tellurite chocolate medium the colony is grey or greyish black after 48 hours ; (3) the morphology on media other than that of Löffler is that of a short diphtheroid bacillus, generally without granules ; on Löffler medium, granules are sometimes well-marked, but are scanty ; (4) the occurrence of pellicle formation and the production of a granular deposit in broth ; (5) initial acid reaction in broth usually reverts to an alkaline one within two days ; (6) it is non-hæmolytic ; (7) it gives the usual fermentation reactions of *B. diphtheriae*, but in addition invariably ferments dextrine, starch and glycogen and fails to ferment glucosamine in 48 hours ; (8) it is associated with more severe cases of diphtheria in which paresis is common and (9) growth is particularly vigorous on the special chocolate tellurite medium.

In contrast, *B. diphtheriae mitis* forms a convex, partly translucent and glossy colony, and, among other characters, does not ferment polysaccharides. The characters of the two forms are fixed.

The medium which has been found to give the sharpest differentiation of colony form is made by adding 10 per cent. of fresh defibrinated rabbit's blood, about 2 per cent. of agar and 0·04 per cent. of potassium tellurite to a meat extract which has never been heated above 75° C. and has been sterilised by filtration, the whole being mixed and heated for 10 to 15 minutes at 75° C. before pouring the plates.

In comparative tests of this medium with Löffler medium on 607 swabs, positive results were obtained on one or the other in 92 cases. In 78 cases the results agreed ; a positive result was obtained only on the tellurite chocolate medium in 11 cases and only on the Löffler medium in three cases. An important feature was that, on the new medium, it was nearly always possible to recognise the type by means of an examination of the colony form at 18 to 24 hours. Comparison of colonies of various organisms including *B. hoffmanni* and other common diphtheroids, *B. influenzae* and streptococci, has shown that the colony type of *B. diphtheriae gravis* is a well marked one.

Tabulated details are given of the various clinical features of the cases associated with each type. It is concluded that, although mild cases may be due to either type and may be indistinguishable, the more severe and toxic cases are generally due to *B. diphtheriae gravis*. This type always shows some virulence by the intracutaneous test on guinea pigs, but no close relationship between virulence for man and guinea pigs was evident.

Six cultures of the Park-Williams 8 strain from various sources were similar to the intermediate form ; this gives a granular deposit in broth and a rather variable colony form, but it does not ferment starch or glycogen.

A. W. STABLEFORTH.

BUXTON, J. B. (1931). **Experimental Studies of the Pathogenicity of the Preisz-Nocard Bacillus for British Sheep.**—*First Rep. Direct. Inst. Anim.*

Path. Cambridge. 1929-30. 39-46. 2 tables. [1 ref.] Cambridge: W. Heffer & Sons, Ltd.

This article describes experiments carried out to determine the susceptibility of British sheep to the Preisz-Nocard bacillus and the distribution of lesions resulting from experimental infection by various routes.

A generalised infection of the lungs and lymphatic glands, and sometimes of the liver and kidneys, was obtained in a large percentage of cases when the bacilli were administered intravenously or *per os*. Similar results were obtained in lambs when the bacilli were introduced through castration and docking wounds. In view of his results with wound infection, the author carried out further oral administration experiments in which he used a stomach tube to diminish the possibility of wound infection in the mouth.

He summarises his results as follows :—100 per cent. of adult sheep and 75 per cent. of lambs showed lung lesions following intravenous injection as compared with 85 per cent. of adult sheep and 66 per cent. of lambs which were infected *via* the stomach tube. In lambs, wound infection was the most severe method of infection. Subcutaneous inoculation appeared to give rise to local lesions only. Comparing these results with those recorded by CRAMP in abattoir work at Sydney, it would seem that wound or oral infection occurs under natural conditions. Climatic and sheep farming conditions in this country, however, do not permit such a heavy contamination of the ground as in Australia.

Further experiments carried out by the author show that sheep readily become infected by contact with animals in which there are open superficial lesions infected with the Preisz-Nocard bacillus ; eight out of ten such in-contact animals showed positive lesions when examined *post-mortem*. The primary seat of the lesions, under the thin skin of the udder and sternum, causes the author to suggest biting insects as possible vectors of the disease in wound infection.

In view of the evident great susceptibility of sheep to infection, it seems doubtful whether the disease occurs in Great Britain, as otherwise a large proportion of sheep in this country would be affected.

NORMAN HOLE.

HUBER, F. L., & KRANEVELD, F. C. (1931). Over de Diagnose van Miltvuur in Ned.-Indië, mede in verband met de wijze van opzenden van het ziektematerial. [**The Diagnosis of Anthrax in the Dutch East Indies and the Manner in which it is affected by the Method of sending the Materials**].—*Ned.-Indisch. Blad. v. Diergeneesk.* **43.** 333-348. 2 tables, 1 plate. [1 ref.]

It has often been found impossible to isolate anthrax bacilli either by culture or by animal inoculation from samples of blood sent to the laboratory on filter paper or on cotton wool, even though it was perfectly clear from the preparations made on the spot that the animals had died of anthrax.

It appeared to be probable that these failures were due either to drying the material too rapidly in the hot sun or to collecting the blood too long after death. In the first case, too rapid drying would quite possibly prevent sporulation and, in the latter, the bacilli present would probably be dead, as putrefaction sets in very rapidly in tropical countries.

A series of experiments was carried out with infective material, using plaster of paris rods, filter paper and cotton wool. The materials collected on the latter were despatched moist or after drying in the shade and in the sun. The results,

which are tabulated, were very contradictory, but the authors think it possible that either filter paper or cotton wool can be used quite successfully for the collection of materials for this purpose. Further tests are to be carried out.

The author gives a description of the changes which occur in anthrax bacilli after death and of the organisms which invade the blood from the intestines.

A. LESLIE SHEATHER.

EATON, M. D. (1931). **A Quantitative Study of the Respiration of Staphylococcus Cultures lysed by Bacteriophage.**—*J. Bacteriol.* **21.** 143-156. 2 tables, 4 figs. [9 refs.]

The effect of the addition of highly active bacteriophage to an actively growing culture of *Staphylococcus aureus* in a Warburg's microrespirometer has been examined. The rate of respiration (uptake of oxygen and evolution of CO_2) was measured and bacterial counts were made over the ensuing period. Immediately after the addition of the bacteriophage, the rate of respiration continued to increase whilst the number of cells remained constant. Later, both the count and the respiration fell off and, finally, a stage of residual respiration continued for several hours after nearly all the cells were lysed. It is shown that the respiration cannot be accounted for by the number of intact cells and it is concluded that there is respiration, either from the bacteriophage itself, or some product of its action on or in combination with bacteria. [The author does not seem to consider the effect of the release of respiratory enzymes from the cells ; these would exert a respiratory power in addition to that of the remaining intact cells. In fact he suggests that one would expect respiration to stop immediately an organism is killed. That this is not so has been shown by several authors in this country.]

W. R. WOOLDRIDGE.

WELD, J. T. P., & GUNTHER, A. (1931). **Differentiation between certain Toxic Properties of Filtrates of Hemolytic** *Staphylococcus aureus*.—*J. Exp. Med.* **54.** 315-322. 2 tables. [18 refs.]

Various workers have shown that sterile filtrates of hæmolytic staphylococci have a destructive action on leucocytes, erythrocytes and on skin, in addition to a quick lethal action when injected intravenously into rabbits. The unity of the substance causing all these toxic effects is, however, a disputed subject. A recent publication by BURNET indicates that only one staphylococcal exotoxin exists and that it exerts its action on erythrocytes, the skin and capillary endothelium.

The authors, however, report experiments which show the presence of at least two antigenically distinct exotoxins in toxic filtrates of *S. aureus*. Their animal experiments were all carried out on rabbits and their filtrates were obtained from four virulent strains of hæmolytic *S. aureus* grown aërobically in modified Walbum's medium, filtered through Berkefeld V candles and preserved in the ice-box under vaseline seals to prevent oxidation. A definite ratio was found to exist between the hæmotoxic, necrotoxic and " acute killing " activities in strongly hæmolytic filtrates ; filtrates with low hæmotoxic strength showed no such quantitative relationship. The leucocidine appeared to have no relationship to any other toxic substances.

By adsorbing the filtrates with red cell stroma, the authors were able to remove hæmotoxin and leucocidin and leave the necrotoxin unchanged. Leucocytes

removed the leucocidin constantly, the hæmotoxin inconstantly and left the necrotoxin undiminished.

The authors therefore conclude that the necrotoxin can be differentiated from either hæmotoxin or leucocidin when present in sterile filtrates of hæmolytic *S. aureus*.

NORMAN HOLE.

WADSWORTH, A., & BROWN, R. (1931). **Chemical and Immunological Studies of the Pneumococcus. II. The Ether-Soluble Fraction of Type I Pneumococcus.**—*J. Immunol.* **21.** 255-260. 1 table. [6 refs.]

Dried, powdered type I pneumococci were extracted with ether and a number of the properties of the residue obtained from the ether extract are described. This is a mixture which appears to be free from protein, glycerol, sterol and carbohydrate and it has the property of fixing complement in the presence of antipneumococcus sera of all types (and also in fact in the presence of a few other organisms). It does not, however, cause the production of any immunity against pneumococcus infection when injected into mice. After ether extraction, the bacterial bodies were found to be approximately as antigenic as the whole organisms, indicating that the essential antigenic substances had not been removed by ether extraction.

W. R. WOOLDRIDGE.

DISEASES CAUSED BY PROTOZOAN PARASITES.

YAKIMOFF, W. L., & RASTEGAÏEFF, E. F. (1931). Sur la bartonellose des chiens en Russie (U.R.S.S.). **[Bartonella Infection of Dogs in Russia].**—*Bull. Soc. Path. exotique.* **24.** 471-473.

Starting with the rat, the authors give a list of animals in which the bartonella parasite has been found. They include the vole, ant-eater, white mouse, squirrel, opossum and two cold-blooded animals, the pike and the frog. The claim of KIKUTH to have demonstrated bartonella in a dog after excision of the spleen is discussed. The opinion of the authors is that KIKUTH was dealing with piroplasmosis of the dog and that bartonella infection was not demonstrated. The question whether bartonella infection occurred in dogs in Leningrad led to the examination of ten dogs. Six of these were normal and there were no changes in the blood. The spleens of the remaining four had been excised : in the latter, there were punctiform inclusions in the erythrocytes up to two months after the operation in the first dog ; in the second dog there was no abnormality up to two months, but similar punctiform inclusions were present from the second till about the sixth month ; no changes were seen in the other two. Infection with bartonella was not seen in any of these dogs. Two of the six normal dogs were further tested by inoculation with blood from the first two splenectomised animals, one subcutaneously and the other intravenously. Examination of their blood did not reveal inclusions in the erythrocytes.

R. LOVELL.

CARPANO, M. (1930). Sur la nature des anaplasmes et en particulier de l'anaplasma centrale. **[The Nature of Anaplasms and of *Anaplasma centrale* in Particular].**—*Ann. Parasitol.* **8.** 231-240. 1 table, 3 figs. [4 refs.]

The author summarises the views that have been expressed by various authors regarding the nature of anaplasms. He points out that bodies closely resembling anaplasms may be encountered in the blood of animals which are certainly not infected with parasites of that type and he is of the opinion that a definite diagnosis of anaplasma can only be made if the bodies under observation are rounded and sharply defined, stain intensely without recognisable internal differentiation, have a practically constant size of 0·6 μ and a marginal position in the corpuscles of which a large number are invaded in the great majority of cases.

Carpano is of the opinion that the parasitic nature of the *Anaplasma centrale* variety is by no means so certain and that even if it were a parasite, it should not be considered as a variety of *Anaplasma marginale* because its biological and morphological features are sufficiently pronounced to separate the two.

The author has frequently noted the following characters in *A. centrale* :— the outline is less regularly rounded than that of *A. marginale* and the margins are not sharp ; there is often a delicate halo and protoplasmic projections are sometimes found ; staining is not always uniformly intense, and some internal structure can be determined ; the size is very variable ; the position in the corpuscles, of which it is rare that more than 15 to 20 per cent. are invaded, is practically always central. What is more interesting, according to the author, is the fact that *Anaplasma centrale* never occurs in a state of purity. Elements of the *Theileria parva* type are always present and, between these and the anaplasms, a range of intermediary forms can be found.

Reference is made to work published in 1913 regarding the occurrence of anaplasma-like forms in artificial cultures of *Nuttallia equi* and in the blood of horses which are recovering or have recovered from infection with that parasite.

Carpano claims to have found similar forms in cultures of *Theileria annulata* and in the blood of cattle infected with that organism, while in his recent investigations on piroplasmosis of the fowl, *Aegyptianella pullorum* infection, he has found anaplasma forms in chronic cases.

It is suggested that structures resembling anaplasms should be divided into two main groups comprising the non-parasitic and the parasitic forms. The latter should be subdivided into three groups :—

Anaplasmoids, which are held to be stages in the development of various piroplasms.

Paranaplasms, microparasites representing transition forms between anaplasms and piroplasms.

Anaplasms—the *Anaplasma marginale* proper.

A. LESLIE SHEATHER.

DISEASES CAUSED BY FILTRABLE VIRUSES.

ANDREWS, W. H., DOBSON, N., BANNATYNE, T., SIMMINS, G. B., WATKINS, C. V., EVANS, J. T., & DAVIES, G. O. (1931). **Detailed Report of Work done at the Experimental Station, Pirbright, and at the Veterinary Laboratory of the Ministry of Agriculture and Fisheries, New Haw, Weybridge. [Appendix I].**—*Fourth Progress Report of the Foot and Mouth Disease Research Committee, Ministry of Agriculture and Fisheries. Great Britain.* pp. 33-140. 24 figs. 9 coloured. London : H.M. Stationery Office. [7s. 6d.]

Survival of the Virus of Foot and Mouth Disease

Influence of the Hydrogen-ion Concentration on the Survival of Virus in Guinea Pig Epithelium.—Epithelium was collected from the plantar pads of guinea pigs which had reacted in 24 hours to virus 1. Discs were cut from these pads and were used as the source of the virus for trial. A series of solutions, both M/15 and M/25 were prepared, giving a range of hydrogen-ion concentrations from pH 6·6 to pH 8·0. The discs were placed in glass stoppered vessels and were kept in the cold store at –1° C. Discs of epithelium were tested from time to time by intradermal inoculation of guinea pigs, from the ninth to the one hundred and fifty-second day. From the forty-ninth to the one hundred and fifty-second day, the virus survived satisfactorily only in those solutions with reactions of pH 7·6, 7·8, and 8·0. Two further series were tested, one kept in the cold store and the other in the cool laboratory. In both series of observations the virus survived longest over the range pH 7·2 to pH 8·0 with the optimum at pH 7·4.

Survival of the Virus in Blood when Dried on Various Substrata.—Blood from reacting guinea pigs was placed on various substances and allowed to dry in a cool laboratory. The virus survived on leather, hides and rubber for 80 days, 89 days and 102 days respectively.

Survival of the Virus in Epithelium when Dried on Various Substrata.—Discs of epithelium from the pads of reacting guinea pigs were placed on various substrata under conditions similar to the test made with blood. The virus survived 27 days on limed walls, two to three weeks on wood, glass and brick, and 45 and 46 days on stockinette and hessian.

Survival of the Virus in Guinea Pig Tissues at Chilling Temperature.—Guinea pigs inoculated with virus 1 reacting +1 were killed and bled, the carcasses were dressed and the organs stored at –2° C. The tissues were tested by guinea pig inoculation and the following maximum periods of survival were recorded :—tendon, 145 days ; bone marrow, 107 days ; liver, 99 days ; kidney and lungs, 96 days ; tongue and fat, 82 days ; and heart, 62 days.

Survival of the Virus at Low Temperatures in the Bovine Carcass.—The cattle were infected by contact with active cases. They were slaughtered at different stages of the infection, but mostly when the temperature was rising. All the carcasses were kept at " chilling " temperature (29° F.) and, as in the imported meat trade, the " offals " were frozen at 15° to 18° F. The following periods of survival of virus were recorded :—up to 33 days in the tongue and cheek and in the washings from an intact quarter ; up to 40 days in meat wrapping cloths soaked in virulent blood ; and up to 80 days in bone marrow and blood clot, all kept at a temperature of 29° F. Hides from these cattle, salted and stored in an ordinary loose box, were found to be infective to swine after 46 days.

Disinfection.

Acids and Alkalies.—Many weak acids and acid salts were used in these experiments. Citric and tartaric acids gave the best results, and solutions of 1 : 1,000 killed the virus within 30 minutes. Ordinary commercial vinegar was effective in 1 : 100 strength after contact for five to nine hours. Ordinary washing soda was found to be a most reliable agent. A 1 per cent. solution destroys the virus within one hour, and a 4 per cent. solution at room temperature kills the virus within 15 minutes. A 4 per cent. solution at 75° C. is effective within five minutes.

Determination of Immunological Types of Virus.

Strains Derived from British Outbreaks.—Twenty-three strains have been examined : 21 of them proved to be of the " O " type ; no " A " or " C " types were encountered. The two remaining strains did not belong to any of the three recognised types and they also differed from each other. Altogether 40 British strains have now been examined and 37 have proved to be of the " O " type.

Foot and Mouth Disease in the Rat, in the Mouse, and in the Hamster.

Two cases are reported in which tissues from common rats have caused infection when inoculated into guinea pigs. One of these rats was caught on a farm which was under control on account of an outbreak of foot and mouth disease, and the second was caught on the Experimental Station, Pirbright. A feature of the spontaneous disease in rats has been the absence of typical lesions, but inoculation of tissues from affected rats into guinea pigs produces the disease. Thirty-three rats were infected by placing them in contact with inoculated reacting rats. Successful attempts were made to transmit the infection from rat to rat by ingestion of rat carcasses. Four guinea pigs reacting to rat strain virus were killed and the carcasses, minus feet, were thrown to three pigs which showed typical foot and mouth disease vesicles within four days. White rats were readily infected by inoculation and by ingestion of infected carcasses, but infection by contact was less successful than with the wild rats.

Excellent plates of drawings and paintings in colour and some photographs, show the types of lesions found in this experimental work on the rat.

House mice were not infected, but, after some failures, white mice reacted with poor lesions. The hamster was shown to be susceptible to inoculation, primary lesions being followed by generalisation.

Foot and Mouth Disease in Cattle and Pigs.

Natural Resistance.—Excluding definitely atypical strains of virus, it has been found that 1·7 per cent. of cattle and 5·3 per cent. of pigs resist infection by intramuscular inoculation.

Occurrence of the Virus in the Blood, Urine, and Milk.—The presence of the virus in the blood during the period of incubation has not been demonstrated until shortly before the beginning of the reaction. Virus may appear in the blood in considerable concentration some hours before the rise in temperature or the appearance of vesicles. Virus appears in the urine quite irregularly and it may make a transitory appearance during the incubation period or even as long as 46 hours before the rise in temperature or the appearance of vesicles. The milk from one cow was shown to contain virus four hours before the temperature reaction had gained the peak of the curve.

The Time of Appearance of Natural Infectivity.—As a rule animals do not appear to be infective during the incubative stage of the disease. Where the temperature rose before any vesicles developed, no evidence was found that the thermal reaction is associated with infectivity for other animals. It would appear that no animal was infective until it showed definite vesicles. There seems to be no doubt that the maximum infectivity occurs immediately after the rupture of the vesicles.

The Decline of Natural Infectivity.—" Receptor " animals were placed in contact with " donor " animals at varying periods after the rupture of lesions

in the donors. On no occasion was the donor or the contaminated box proved to be infective longer than four days after the rupture of the vesicles.

THE DURATION OF IMMUNITY IN CATTLE.—Immune cattle have been tested over periods lasting as long as 32 months, without demonstrating any loss of humoral immunity. "Tissue" immunity has been tested by intradermal inoculation into the tongue. Animals tested a few weeks after recovery have not shown any kind of reaction except the local one. In one group, four cattle were tested 15 to 20 months after the original inoculation and responded with generalisation.

CHEMOTHERAPY.

IODINE.—The claim made by WALKER & TAYLOR that iodine exercises a useful therapeutic action on foot and mouth disease infection in cattle has not been confirmed.

COLLOIDAL METALS.—Colloidal preparations of hydrargyrum, sulphur, iodine, arsenicum, cuprum, and ferrum, have been tested, but the observations do not suggest that these preparations have any real value as viricidal agents.

NORMAN DOBSON.

EDWARDS, J. T., CIUCA, A., & GIBBS, Y. M. (1931). **Detailed Report of Work done at the Lister Institute of Preventive Medicine, Chelsea, London. [Appendix II].**—*Fourth Progress Report of the Foot and Mouth Disease Research Committee, Ministry of Agriculture and Fisheries. Great Britain.* pp. 141-209. [27 refs.] London : H.M. Stationery Office. [7s. 6d.]

PHYSICAL PROPERTIES OF A VIRUS.

It was found that, using a Seitz filter and virus in saline phosphate solution at pH 7·6, the first 5-10 c.c. of filtrate contained a lower concentration of virus than the last 20 c.c., in which the titre was undiminished.

In a cataphoresis experiment, virus in phosphate at pH 7·6 passed to the anode and not towards the kathode, indicating that the virus carried a negative charge.

IMMUNITY.

VACCINATION.—Recent work has been directed chiefly towards finding the most effective way of using the vaccine, the time at which the immunity is greatest, its duration and the nature of the immunity produced. After the virus has been killed at 26° C. formolised vaccine can be kept in good condition for seven months in the cold store at ± 5° C. No difference could be seen in the results following the intramuscular and intradermal methods of inoculation, but the intravenous route was decidedly inferior. After inoculation with 0·5 to 2·0 c.c. of vaccine, the protection against generalisation following intradermal inoculation of virus was at its maximum by about the fourth day ; it had begun to decrease by the seventh day and had nearly disappeared by the twenty-first day. After inoculation with 2·0 c.c. of vaccine, guinea pigs were completely protected against intramuscular inoculation for at least 20 weeks.

SUSCEPTIBILITY OF DIFFERENT SPECIES OF ANIMALS TO FOOT AND MOUTH DISEASE.

Very small lesions on the tongue, lips and gums of wild rabbits were found after the intradermal inoculation of 0·2 c.c. into the tongue and of 1·0 c.c. intramuscularly. It has been confirmed that the hedgehog is highly susceptible

to infection with the " O " type virus ; in the hedgehog, the disease appears to be more fatal than in any other species of susceptible animal. Infection has been obtained by feeding and by contact.

THE RESPIRATORY EXCHANGE OF THE FOOT AND MOUTH DISEASE VIRUS.

ITS SIGNIFICANCE IN DETERMINING THE CONDITIONS REQUIRED FOR THE SURVIVAL AND GROWTH OF THE VIRUS.—The virus survives best in distilled water when the acid base reaction is adjusted to pH 7·6. This degree of alkalinity of the medium needed for optimum survival is conditioned by the respiratory requirements of the virus, since, in such a medium, it has to depend for its supply of " free energy " directly upon molecular oxygen ; that is to say, it has to derive its " free energy " from the most inert of available sources and the rate of oxidation is greatest in the more alkaline fluids. At the site of the multiplication of the virus in the animal body, the oxidation-reduction conditions differ from those of the fairly stable media in which the virus can survive well outside the body. The " reducing power " of the susceptible living tissue is considerably higher and with this there are compensatory changes in pH. and Eh. which are " more acid " and " more reducing " respectively.

NORMAN DOBSON.

GALLOWAY, I. A. (1931). **Detailed Report of Work at the National Institute for Medical Research, Hampstead. [Appendix III].**—*Fourth Progress Report of the Foot and Mouth Disease Research Committee, Ministry of Agriculture and Fisheries. Great Britain.* pp. 210-344. [139 refs.] London : H.M. Stationery Office. [7s. 6d.]

CHEMOTHERAPEUTIC EXPERIMENTS.—Ninety chemical substances have been tested ; 36 of these were dyes and the remaining 54 included three compounds of arsenic ; five of mercury ; three of bismuth ; seven of formaldehyde ; two cupreine derivatives ; salts of copper, cobalt, chromium, nickel, lead, antimony, gold, platinum, iron, vanadium, cæsium, cerium and chromic acid ; colloidal metals, (copper, platinum, silver and manganese) ; sodium salicylate ; hexyl resorcinol ; emetine hydrochloride ; intramine and Fourneau 309 (Bayer 205). When given in non-toxic doses, none of these substances were found definitely to modify the reaction of the virus of foot and mouth disease in guinea pigs.

THE SURVIVAL OF VIRUS IN MILK AND DRIED MILK AND THE EFFECT OF HEAT ON THE VIRUS SUSPENDED IN MILK OR CONTAINED IN DRIED MILK.—It has been shown that fresh milk which has been " chilled " immediately after being drawn from the cow, stored at a temperature of 4° C. and artificially contaminated with virus, will give positive reactions in guinea pigs for about 15 days. Unfiltered virus was added to milk which had been steamed for 15 minutes at 100° C. and stored at room temperature for 35 days. Tests at this time showed the virus to be active.

Feeding stuffs and bedding material, contaminated with milk containing virus, gave positive reactions after exposure to air under natural conditions for 32 days. Milk containing virus rapidly dried and stored *in vacuo*, and milk powder stored in rubber corked glass tubes, gave positive reactions after 43 and 32 days respectively. Milk containing virus was sealed in capillary tubes and immersed in water at various temperatures for short periods. When tested afterwards it was found to be virulent after exposure to a temperature of 60° C. or 65° C. for two and a half seconds. Prolonging the period to five seconds rendered the virus non-infective. Exposure to temperatures above 65° C.,

even for two and a half seconds, killed the virus. Fresh milk was contaminated and partially dried *in vacuo*. The resulting fine scales were placed in glass tubes and immersed in water at varying temperatures from 65° C. to 100° C. The virus in the partially dried milk was still infective after exposure to 100° C. for 10 seconds, to 95° C., 90° C. or 85° C. for thirty seconds, to 80° C. for one minute and to 70° C. or 75° C. for five minutes.

The Survival of the Virus of Foot and Mouth Disease at Low and Variable Temperatures.—It has been shown that virus contained in pad emulsion in phosphate saline solution is not affected by freezing and thawing, but that the virus in vesicle lymph rapidly loses its activity under similar conditions. The alternate freezing and thawing of infected guinea pig carcasses does not appear to affect the survival of the virus.

Experiments to Determine the Quantity of Virus in an Infected Guinea Pig Carcass, and the Relative Virus Content of Different Organs and Tissues.—It is shown that the vesicle lymph, epithelium of the pads, mucous membrane of the tongue and cheeks and the blood serum contain the bulk of the virus.

The Methods other than Inoculation, by which Guinea Pigs may be Infected.—Spontaneous infection only occurs when the source of infection from infected to susceptible guinea pigs is renewed and intensified. Contact infection requires the absolute contact of susceptible guinea pigs with the infected ones. The presence of a perforated zinc division in the cage is sufficient to prevent infection. Guinea pigs have been infected by feeding with virus-contaminated food when the mucous membrane of the tongue has previously been scarified. It is also shown that guinea pigs may be infected by spraying virus into the nostrils, or on to the external genital organs, or by introducing virus direct into the trachea or stomach.

Immunity and Vaccination.—A vaccine prepared from guinea pig vesicle lymph, or vesicle lymph and emulsified pads with 1 to 2 per cent. phenol glycerol, protects guinea pigs against generalisation, but not against the development of local lesions. Virus in bile was inactivated by contact for 24 hours at 37° C. or for three days at 18° to 20° C., and it protected five out of six guinea pigs against generalised lesions. Attempts to inactivate the virus by means of a mercury arc lamp yielded negative results.

Survival of Virus Introduced into the Tissues of Immunised Rabbits and Guinea Pigs.—Virus introduced into the mucous membrane of the tongue of immune rabbits could not be recovered from the second to the thirty-sixth hour, whereas it was proved to be present in the guinea pig 30 minutes to 24 hours after inoculation.

Preliminary Report on Studies of Foot and Mouth Disease in the Cat.—Only preliminary reports are quoted showing that some cats have been infected by inoculation of virus intralingually, in one case by contact and in another case by feeding with milk contaminated with virus.

NORMAN DOBSON.

I. Watanabe, M. (1931). Sur l'anticorps spécifique dans le sérum du lapin infecté par le virus rabique fixe. [**The Specific Antibody in the Serum of Rabbits infected with the Fixed Virus of Rabies**].—*J. Jap. Soc. Vet. Sci.* **10**, 11-18. 8 tables. [10 refs.]

II. REMLINGER, P., & BAILLY, J. (1931). La déchéance du sérum antirabique. **[The Decadence in Value of Antirabic Serum].**—*Bull. Acad. vét. France.* **4.** 239-243. [5 refs.]

I. By inoculating rabbits subdurally with a fixed rabies virus which had been treated by desiccation, heat or chemical agents, so that the period of incubation was prolonged to more than eight days, the author was able to demonstrate, by *in vitro* and *in vivo* tests, the existence of specific antibodies in the serum drawn off just prior to death. Such sera were found to give positive complement fixation reactions when either fixed-virus antigen or street-virus antigens were employed. Satisfactory results were given in control experiments in which sera both from normal rabbits and from rabbits inoculated with the normal virulent virus were used. From a number of tests in which guinea pigs were inoculated subcutaneously with such a serum, he found that 1 c.c. would protect against 100 lethal doses of fixed virus, whether the serum was given 24 hours before, simultaneously with or 24 hours after the virus inoculation.

II. These authors consider that, in view of the difficulty of its preparation, the variable products obtained and its doubtful value as a preventive or diagnostic agent, the use of antirabic serum is not justified. This conclusion was drawn from the results of experimental work in which it was found that, although the dog was the best serum producer, the product so obtained was very variable in its rabicidal power, its regularity of action and in its antigenic range (i.e. the number of viruses against which it was effective). The virulence or amount of the virus used in immunisation did not appear to be related to the immunising properties of the serum obtained. Even when used in the laboratory for the differential diagnosis of rabies and neurotropic viruses, antirabic sera are not dependable and the authors quote an example in which a suspected virus of encephalo-myelitis proved to be a rabies virus, despite the fact that no protection against the suspected virus had been afforded to guinea pigs by inoculation with an antirabic serum of known value.

NORMAN HOLE.

REMLINGER, P., & BAILLY, J. (1931). Les confusions entre les virus neurotropes et le virus rabique. Moyens de les éviter. **[The Confusions existing between the Neurotropic Viruses and the Virus of Rabies and Methods of avoiding them].**—*Bull. Inst. Pasteur.* **29.** 1-13. [17 refs.]

It is generally recognised that the symptoms exhibited by rabies both in man and in animals are very variable and frequently tend to obscure the diagnosis.

On the other hand, there is a common belief that the virus of rabies is strongly characteristic and, though belonging to the large group of neurotropic viruses, is unlikely to be confused with other members of that group.

The authors do not share the opinion that the presence or absence of Negri bodies, combined with animal inoculations (rabbit and dog), will invariably permit of a correct diagnosis.

They review the principal errors in diagnosis which have occurred between rabies and other neurotropic virus infections to which references occur in the literature on the subject. Some have had as starting point a human infection (epidemic encephalitis), others an affected animal (" maladie d'Aujeszky," acute contagious encephalitis of bovines, etc.).

Human Pathology.

The Virus of Koritschoner.—This virus was isolated by Koritschoner from the brain of a patient who, having been bitten by a rabid dog, was submitted to antirabic treatment and died 30 days after the last inoculation and 42 days after having been bitten. Negri bodies were not found either in the brain or in rabbits inoculated from the brain. This virus was the subject of much study and gave rise to considerable controversy.

Finally, comparative studies of Koritschoner's virus with "virus fixe," a street virus, a herpes virus, an encephalitis virus and the sera of rabbits immunised against all these different viruses, proved it to be a rabies virus—but atypical in that it killed rabbits in from four to five days.

The Encephalitis Virus of Kobayashi.—This virus was isolated by Kobayashi (1925) during an epidemic of encephalitis which occurred in Japan in 1924. Cross-immunity tests carried out by Cowdry (1927) have definitely proved it to be a rabies virus.

Herpes Virus DK.—Cross-immunity tests carried out by Nicolau and Kopciowska proved this to be a typical rabies virus.

Virus Eck (Silberstein).—The identification of this virus has given rise to considerable difficulties. Silberstein and his collaborators believed it to be a herpeto-encephalitis virus, but Nicolau considered it to be a rabies virus.

Kraus and Takaki have recently studied the virus with their Kokto antigen and complement fixation and have shown that the virus is neither a herpeto-encephalitis virus nor a rabies virus. The problem remains unsettled.

Animal Pathology.

Rabies Epizootic in the State of Santa-Catharina [Southern Brazil].—An outbreak of disease, which Carini diagnosed as rabies [(1911). *Ann. Inst. Pasteur.* **25.** 847-851.], occurred in the State of Santa-Catharina and caused the death of thousands of cattle, horses and mules. Two forms of the disease were observed—a furious and a paralytic form. The duration of illness was a couple of days ; both forms were fatal, the animals becoming paralysed before death. Negri bodies were present in the brains of affected animals and inoculations into rabbits produced the typical syndrome of rabies.

The disease did not occur in either the dog or human population and Remlinger and Bailly suggest that this should have aroused suspicions as to the accuracy of the diagnosis of rabies.

A campaign for the eradication of dogs was, however, enforced and many thousands were destroyed, but this did not have any appreciable influence on the incidence of the disease.

As bats were observed biting cattle during the day and as bitten cattle later contracted the disease, the bats were immediately incriminated as vectors of rabies and wide publicity was given to this epidemiological discovery. Eventually it was shown by Kraus, Negrette and Kantor, working with material received from Carini, that the disease was not rabies, but pseudo-bulbar paralysis ("maladie d'Aujeszky").

Rabies in the State of Rio Grande Do Sul [Southern Brazil].—For a long time now, a disease of horses and cattle, described as "peste das cadeiras," has been known in Brazil, especially in the State of Rio Grande do Sul. In view of the presence of Negri bodies and of the pathogenicity of brain tissue for dogs and rabbits, a diagnosis of rabies was made. The authors state that Professor Leclainche has pointed out that, even without any anatomical or experimental

investigation, an error in diagnosis had obviously occurred as " dans le seul district de Balem on signale en une année 1,632 morts, dont 1,175 bovidés, 428 chevaux, 112 moutons, 16 porcs et un seul chien."

The authors conclude that the disease present in the State of Rio Grande do Sul, as in the State of Santa-Catharina, is the " maladie d'Aujeszky " and that, if the error in diagnosis made by CARINI and by HAUPT and REHAAG, had been given greater publicity, its repetition would have been avoided. [The names of the last two authors are erroneously spelt HAMPT and REBAAG.]

ACUTE CONTAGIOUS ENCEPHALITIS OF CATTLE. (DONATIEN and BOSSELUT.)—Remlinger and Bailly remark that, while in Brazil pseudo-bulbar paralysis has been confused with rabies, rabies in cattle in Algiers has been wrongly diagnosed and described as " acute contagious encephalitis of cattle."

Out of a herd of 20 cattle, 10 were infected and nine died ; none of the affected animals showed either paralysis or glycosuria.

DONATIEN and BOSSELUT showed experimentally that the brain, spinal cord and retina of affected animals were virulent and that the virus could be passed through Chamberland L filter candles.

The most characteristic feature of the experimentally induced disease was the very short period of incubation which never exceeded 24 hours.

In a second publication, three years later, DONATIEN and BOSSELUT reported that further investigations, including cross-immunity tests, had proved the virus to be that of rabies.

MENINGO-MYELITE DES JEUNES CHIENS. [? Distemper] (REMLINGER and BAILLY).—The authors record a case of rabies in a dog, aged four months, mistaken for this infection and that it was not until the virus had been passaged four times through dogs that the infection was correctly diagnosed.

HOW CAN THE EXISTING CONFUSION BETWEEN RABIES VIRUS AND OTHER NEUROTROPIC VIRUSES BE AVOIDED ?—This can be done by keeping in mind the fact that rabies virus is not strongly characteristic and that there is perhaps greater similarity between it and certain neurotropic viruses than there is between the diseases induced by those viruses and rabies itself.

According to Remlinger and Bailly, a review of the diagnostic errors which have occurred gives the impression that the difficulties encountered were not beyond the powers of the clinician and that laboratory intervention has on occasion obscured rather than assisted in solving the problems.

The authors are of the opinion that diagnosis should not be based solely on the lesions of BABES or of VAN GEHUCHTEN, as they are too indefinite, nor even on the presence of Negri bodies. Numerous and typical Negri bodies were found by CARINI in affected cattle in the State of Santa-Catharina, but the disease was pseudo-bulbar paralysis (" Maladie d'Aujeszky ") and not rabies.

In the case of the virus of KORITSCHONER, Negri bodies were not found either in the brain of the patient or in rabbits inoculated with brain tissue, yet this virus was subsequently proved to be a rabies virus.

Similarly, NICOLAU and KOPCIOWSKA did not find Negri bodies in the virus DK, but cross-immunity tests proved it to be a rabies virus.

Animal inoculations are a more reliable aid to diagnosis than are anatomical alterations.

As neurotropic viruses are in general pathogenic for the rabbit and the dog and as they usually produce paralytic symptoms, it is advisable to employ various species of animals and different routes of inoculation.

In the dog and the rabbit, in addition to the intracerebral route, it is advisable to make inoculations both into the anterior chamber of the eye and by scarification of the cornea.

Even animal inoculation sometimes leaves the diagnosis in doubt and recourse must then be had to two methods of capital importance—serological and cross-immunity tests.

The authors describe in detail the technique of the serological and cross-immunity tests which they consider should be undertaken and they mention some of the pitfalls which may be encountered.

In the cross-immunity tests, they advise the immunisation of rabbits (or dogs) with " virus fixe," a " street " virus, the virus under test and one or two viruses of the same group as that to which the unknown virus is thought to belong. [Another paper on the same subject by REMLINGER, (1931). *Ann. Inst. Pasteur.* **47.** 608. will be dealt with in the next number of this *Bulletin.*]

[See also HURST and PAWAN, this *Bulletin.* **1.** 285, and ROSENBUSCH, this *Bulletin.* **2.** 12 & 13.]

T. M. DOYLE.

MARIE, A. C., & URBAIN, A. (1931). Sur l'antagonisme du virus herpétique et du virus rabique. **[Antagonistic Action of Herpes and Rabies Virus].**—*C.R. Soc. Biol. Paris.* **107.** 1488-1490. [3 refs.]

BEDSON, S. P. (1931). **Immunisation with Killed Herpes Virus.**—*Brit. J. Exp. Path.* **12.** 254-260. 9 tables. [4 refs.]

SMITH, W. (1931). **The Effect of Testicular Passage on the Virus of Herpes.**—*J. Path. Bact.* **34.** 747-750. 1 table. [2 refs.]

Equal amounts of emulsions of infective herpetic and rabic brains in the proportion of 1 part of brain to 10 of broth were mixed together. After contact, either at room temperature for 30 minutes or at 4° C. for six hours, they were injected (a) into rabbits by the cerebral route or by cutaneous scarification ; and (b) into guinea pigs by intramuscular inoculation in the cervical region. The results showed that the two viruses, after admixture, still preserved their respective infectivity and that they exhibited no inhibitory action against one another. In addition, rabbits immunised against the virus of herpes succumbed to the intra-cerebral inoculation of rabies virus, and *vice versa.*

Bedson compares the immunising value of killed with living herpes virus. Three doses of guinea pig virus rendered inert by 0·2 per cent. formalin were capable of exciting a high degree of immunity, whereas three doses of virus, killed by heating to 60° C. for 45 minutes or to 100° C. for 20 minutes, had little immunising power. One dose of formolised virus gave an appreciable immunity which in some instances was almost as great as that evoked by living virus. Although heat killed virus was impotent, virus first treated with formalin and then heated to 100° C. was still capable of producing some immunity.

Wilson Smith, who has previously described the adrenal lesions caused by herpes virus, found that the adrenal activity varied with skin infectivity. In the present paper, he shows that testicular passage modifies the activity of the virus. A strain maintained by serial passages through rabbit brains never caused a skin reaction in a dilution higher than 1 to 10 and was almost without effect on the adrenal glands. The same strain passed through the testis gave rise to a skin reaction in a 1 to 1,000 dilution and evoked very extensive adrenal lesions. Further experiments on the minimal lethal dose of infective brain and testis, respectively, suggest that this effect was dependent upon the greater infectivity of the testis and was not due to a non-specific factor contained in normal testicular tissue as described by DURAN-REYNOLDS in vaccinia.

R. E. GLOVER.

SCHULTZ, E. W., GEBHARDT, L. P., & BULLOCK, L. T. (1931). **Studies on the Antigenic Properties of the Ultraviruses. VII. Nature of the Viricidal Antibody in Antipoliomyelitis Serum.**—*J. Immunol.* **21.** 171-198. 4 tables. [52 refs.]

In previous papers, the authors demonstrated the formation of neutralising antibodies to the viruses of vaccinia, rabies and herpes, but no evidence of specific complement-fixing or precipitating antibodies could be adduced. In the present communication, they have extended their observations to the virus of poliomyelitis. The sera were obtained, either from convalescent or hyper-immunised monkeys or from persons whose sera exhibited well defined viricidal properties. In conducting the viricidal tests, 5 per cent. saline emulsions of virus cord, lightly centrifuged and filtered through paper, were added to equal quantities of inactivated serum, and the mixtures, after incubation at 37° C. for two hours, were injected intracerebrally into monkeys. The complement-fixation tests were carried out in the customary manner, while three types of antigen were used in the precipitin tests, viz., a saline suspension of cord heated to 100° C. for 15 minutes ; ultrafiltrates (0·5 per cent. collodion membranes) and aqueous solutions obtained after ether extraction.

While viricidal antibodies were easily demonstrated in the sera from human and monkey sources, no complement-fixing or precipitating antibodies were found even in the sera of hyperimmunised monkeys. The results suggested that the antibodies resembled antitoxin more closely than bactericidal antibodies. This hypothesis was strengthened by experiments on neutral serum-virus mixtures, for, whereas an undiluted serum-virus emulsion failed to infect, a similar mixture diluted with nine volumes of saline solution became infective. Further experiments showed that the time factor was also of importance, for, while an undiluted serum would render a given quantity of virus immediately innocuous, when the same serum was first diluted a certain minimum *time* was required.

R. E. GLOVER.

HARMON, P. H., SHAUGNESSY, H. J., & GORDON, F. B. (1931). **Preparalytic Poliomyelitis in the Monkey. Changes in Temperature, Spinal Fluid, Blood and Erythrocyte Sedimentation.**—*J. Prev. Med.* **5.** 115-137. 7 tables, 2 figs. [27 refs.]

Five to eight days after the intracerebral inoculation of a potent poliomyelitis virus into monkeys, certain prodromal symptoms occur, such as restlessness, passivity, cries, ruffled fur and tremors which precede the actual flaccid paralysis. Owing to the variability of these symptoms, experiments have been carried out to obtain a more accurate guide to the approaching paralysis. Observations on rectal temperatures showed that, in inoculated monkeys, the temperature usually rose 2° to 3° F., about five days after inoculation and fell again with the onset of paralysis about three days later. A drop in the temperature frequently occurred before the onset of paralysis, but it rose and fell again subsequently with approaching paralysis. The latter thermic response, which was thought to be peculiar to the human form of the disease, is called the " dromedary type." After paralysis, the temperature usually continues to fall, becoming subnormal until death. Variations from the above description are encountered, the temperature rise occurring sometimes before and sometimes after five days, but usually preceding paralysis by one to three days.

Examination of the spinal fluid showed that, in infected monkeys, the number of lymphocytes and the globulin content markedly increase during the one or two

days preceding paralysis. Within 48 to 72 hours after the onset of paralysis, a drop in the number of lymphocytes occurs, frequently accompanied by a negative reaction to the Ross-Jones globulin test.

No appreciable change was found in the total leucocyte content of the blood of infected monkeys prior to the onset of paralysis, but differential examination showed a decrease in the circulating lymphocytes and an increase in polymorphonuclear neutrophilic leucocytes about the time of the pre-paralytic rise in temperature. The total leucocyte count usually diminishes after paralysis sets in, due to a drop in the counts of both lymphocytes and of polymorphonuclear leucocytes. The sedimentation velocity of the erythrocytes of infected monkeys shows no difference from that of non-infected controls.

The above results emphasise the close relationship of poliomyelitis in the monkey to that occurring in man.

W. R. WOOLDRIDGE.

LEVADITI, C., LÉPINE, P., & SCHOEN, R. (1931). Virulence et neurotropisme du virus vaccinal. **[The Virulence and Neurotropism of Vaccine Virus]**.—*C.R. Soc. Biol. Paris.* **107.** 802-804. [7 refs.]

BLANC, G., & CAMINOPETROS, J. (1931). Quelques observations et expériences sur l'adaption de la vaccine au névraxe du lapin. **[Experiments on the Transmission of Vaccine Virus to the Nervous System of the Rabbit]**.—*Ibid* 1530-1532. [3 refs.]

Levaditi and his co-workers have previously shown that the highly neurotropic strains resulting from the brain to brain passage of vaccine virus in the rabbit are frequently responsible for spontaneous outbreaks amongst normal stock.

In the present communication, they have compared the virulence of two strains, one of which had not previously been passed through the rabbit, while the other was a spontaneous strain of neurovaccine. The former, which had been propagated solely in cattle with occasional transferences to man, gave rise to well-marked dermal and testicular lesions in the rabbit, but was incapable of provoking a vaccinal encephalitis even after transference through the testicle. On the other hand, it was fatal to a monkey by the subdural route. The second strain was derived from rabbits which had received an intracerebral inoculation of human brain substance (condition unconnected with vaccinia) and was undoubtedly a neurotropic type of spontaneous origin. In this case, passage from brain to brain was readily obtained, death ensuing in from five to six days.

On this point, Blanc and Caminopetros are in agreement with Levaditi. On a previous occasion, they had noted that the intracerebral inoculation of the rabbit with sheep-pox virus had given rise to an encephalitis of a vaccinal type, but, as they had been unable to repeat the experiment, they had expressly refrained from offering any comments on these results. They now put forward the hypothesis that, as they were working with a highly neurotropic strain of vaccinia at that time, the inoculation of the sheep-pox material precipitated an encephalitis in rabbits which were harbouring vaccine virus. They also observe that, by rapidly transferring vaccine virus from cornea to cornea in the rabbit, it can be readily transmitted to the brain.

R. E. GLOVER.

BIERBAUM, K., EBERBECK, E., & KAYSER, W. (1931). Anpassung von Taubenpocken-virus an das Huhn. **[The Transmission of the Pigeon-Pox Virus**

to the Fowl].—*Arch. wiss. prakt. Tierhlk.* **64.** 20-28. 1 table, 5 text figs. [5 refs.]

In a previous publication, the authors found that the fowl-pox virus was transmissible to the pigeon only when it was " bipathogenic." They succeeded in infecting pigeons with the Zwick fowl-pox virus. The lesions were less marked than those produced in fowls, but microscopical examination left no doubt as to their nature. It appeared to be probable that the failures recorded by other authors were due to the use of " mono-pathogenic " strains of the virus.

In these circumstances, Bierbaum and Eberbeck thought that the reverse experiments should be repeated, using the histological examination of the tissues to control the results.

The virus used was the Lahaye vaccine against pigeon-pox which was purchased from the Antwerp Laboratory.

According to LAHAYE, this virus is attenuated by passage through pigeons and, while it confers an absolute immunity, is capable of producing only localised lesions by inoculation.

Tabular statements show the way in which this virus was carried in fowls and transmitted from fowls to pigeons. The lesions in the fowls of the early passages were slight, but definite, and histological examination of sections clearly established their nature.

The authors quote experiments and observations in support of the view that the virus used was not a mixture of fowl and pigeon viruses, but actually a virus possessing pathogenic powers for the two species of birds. In some of the later passages mouth lesions were produced.

The virus, which was carried on in fowls through 14 passages, retained its normal infectivity for the pigeon throughout.

It appears that there are pox strains which are specifically pathogenic for the fowl and the pigeon, but that there are also strains which are pathogenic, possibly in a varying degree, to both species of bird.

A. LESLIE SHEATHER.

MOOSER, H., CASTANEDA, M. RUIZ, & ZINSSER, Hans. (1931). **The Transmission of the Virus of Mexican Typhus Fever from Rat to Rat by** *Polypax spinulosus*.—*J. Exp. Med.* **54.** 567-575. 2 tables. [5 refs.]

In continuation of previous work on typhus fever [See this *Bulletin*. **1.** 135 & 295.], the authors have been able to show that rat to rat transmission of Mexican typhus fever can be effected by feeding the common rat louse, *Polypax spinulosus*, first on infected and then on healthy rats. It has not yet been determined whether infection occurs from the louse bite or from fæcal contamination of skin abrasions.

The degree of louse infection was found to depend on the severity of the rat infection ; 100 per cent. of the lice fed on benzolised infected rats [see this *Bulletin*. **1.** 135] showed large numbers of rickettsiae in smear preparations, but fewer of those taken from less severe rat cases showed the organisms. The rickettsiae appeared to invade and destroy the lining epithelium of the louse gut.

The evidence pointed to actual multiplication of the rickettsiae in the louse and the authors conclude that, although *Polypax spinulosus* cannot transmit the disease from rats to human beings (as it does not feed on man), it is an important factor in natural rat to rat transmission of Mexican typhus fever.

NORMAN HOLE.

BEALE, H. P. (1931). **Specificity of the Precipitin Reaction in Tobacco Mosaic Disease.**—*J. Exp. Med.* **54.** 463-473. 3 tables. [8 refs.]

The author has previously shown that, if rabbits are given a series of injections of saline extracts from tobacco plants affected with the filtrable virus of tobacco mosaic disease, the serum of these animals forms a heavy precipitate when mixed with extract of affected leaves, but only a slight precipitate when mixed with extract of healthy tobacco plant. She has also shown that normal rabbit serum does not form a precipitate and that the serum of a rabbit inoculated with normal tobacco leaf extract forms only a slight precipitate when mixed with the homologous extract, or with extract of diseased tobacco leaf. Serum prepared against extract of diseased leaf was absorbed with extract of normal leaf until it no longer formed a precipitate against normal leaf extract ; it was then tested against diseased leaf extract and was found to be still strongly precipitating.

From these results it was evident that there was some antigenic material in diseased leaf extract which was not present in normal leaf. This antigenic material might be either foreign protein or protein of the tobacco plant altered by mosaic disease. If foreign protein, it might be virus itself or protein from secondary organisms present in the diseased plant.

Three sets of experiments were devised in order to ascertain the specificity of the precipitin reaction. In these experiments, only one antiserum was used, *viz.* that prepared against extract of tobacco affected with common field mosaic disease. The sources of the extract used in each of the three experiments were as follows :—

(1) From plants other than tobacco, affected with virus diseases distinct from tobacco mosaic.

(2) From various plants all affected with the same virus, *viz.* common field mosaic disease of tobacco.

(3) From tobacco plants affected with viruses distinct from tobacco mosaic disease.

In Experiment 1, extracts of various plants (Sudan grass, hippeastrum, lily, abutilon and peach) affected with different viruses were mixed with the antiserum, prepared against extract of tobacco affected with tobacco mosaic disease. It was found that a precipitate was formed only in the mixture of antiserum and virus extract of tobacco mosaic disease.

In Experiment 2, extracts of tomato, pepper, petunia, *Nicotiana rustica*, *Martynia louisiana* and *Nicotiana glutinosa* infected with tobacco mosaic disease, all formed precipitates when mixed with antiserum prepared against *Nicotiana tabacum* (Turkish tobacco plant) infected with two virus diseases (not mosaic).

In Experiment 3, Turkish tobacco plant (*Nicotiana tabacum*) was infected with ringspot disease and cucumber mosaic disease and *Nicotiana glutinosa* with cucumber disease. Extracts of the infected plants were mixed separately with the antiserum. It was found that Turkish tobacco infected with ringspot or cucumber mosaic disease formed only a slight precipitate with the undiluted antiserum and no precipitate with serum diluted 1 in 4. Extract from *N. glutinosa* produced only a slight precipitate with undiluted serum and no precipitate with serum diluted 1 in 4.

The results of these experiments suggest that the specific antigenic substance in virus extract of tobacco mosaic disease is foreign antigenic material, perhaps virus itself, and not altered protein of the host.

C. McG.

INVERTEBRATE VECTORS OF DISEASE.

HOARE, C. A. (1931). **The Peritrophic Membrane of Glossina and its Bearing upon the Life-Cycle of** *Trypanosoma grayi*.—*Trans. Roy. Soc. Trop. Med. Hyg. London.* **25.** 57-64. 2 figs. [9 refs.]

The mode of origin, structure and function of the peritrophic membrane were first fully described by WIGGLESWORTH in 1929, although it had been described (inaccurately) by STUHLMAN in 1907. This membrane is a thin cylindrical chitinous sheath which arises from the proventriculus and extends throughout the length of the alimentary canal ; it is attached anteriorly and free posteriorly. It prevents the food of the fly from coming into contact with the epithelium and acts as a dialyser during digestion.

Hitherto no attempt has been made to correlate its presence with the development of the various trypanosomes infecting the insects. This is probably because, in the study of the insects, the examination of sections has been neglected, attention having been paid principally to smear preparations.

The author describes with figures the movements in glossina of the crocodile trypanosome, *T. grayi*. During the first three days of development, the parasites are intraperitrophic in the mid gut. By the fifth day, while still within the lumen of the peritrophic membrane, a large number of the parasites have migrated towards the posterior part of it. On reaching the open end of the membrane in the hind gut, the parasites invade the extratrophic space (between the membrane and the lining of the gut), and become attached to the epithelium. Migration forward takes place as the number of parasites emerging from the membrane increases and, as the development proceeds, the parasites are gradually evacuated *via* the rectum. Hoare is of the opinion that the peritrophic membrane is gradually regenerated from the anterior end, the posterior free end being gradually discarded. This is in disagreement with WIGGLESWORTH'S view that it is completely renewed at each meal. Hoare gives reasons for his views.

The study of the hind gut of the tsetse flies has been neglected and the author gives a short revised description of it which is illustrated by a diagram. It appears that the anal spines may possibly serve to hold the peritrophic membrane, and prevent it from being drawn forward.

A. LESLIE SHEATHER.

DISEASES CAUSED BY METAZOAN PARASITES.

COULON, G., & DINULESCU, G. (1931). Un cas de myiase oculaire à *Oestrus ovis* L. en Corse. [**A Case of Ocular Myiasis in Corsica due to** *Oestrus ovis* L.].—*Ann. Parasitol.* **9.** 140-143. 6 plates.

In place of a description, the authors give sketches of the larvae taken from the conjunctival sac of a young worker in Corsica. The man had not been in contact with sheep. There were 15 larvae in each eye and, although the authors think that the larvae must have been observed very soon after they were laid, yet there were indications that they might have been approaching the second stage of development. In view of the numbers laid at a time, the authors think that further evidence of the viviparous habits of the species is provided.

U. F. RICHARDSON.

BUXTON, P. A. (1931). **The Measurement and Control of Atmospheric Humidity in Relation to Entomological Problems.**—*Bull. Entom. Res.* **22.** 431-447. 5 graphs, 3 figs. [23 refs.]

This article discusses methods of measuring and controlling atmospheric humidity in connection with entomological observations and deals with the errors which may occur owing to the limited applicability of the various methods.

Methods of measurement by means of dry and wet bulb thermometers, hygroscopic substances, dewpoint and chemical hygrometers are discussed.

Hair hygroscopes which operate a fan controlling ventilation when humidity rises or falls above or below the required figure can be used, and recording forms are also available. Hair hygrometers develop errors, however, if kept at high temperatures and at a high degree of humidity.

Chemical hygroscopes are made of glass and are fragile ; their main advantage is that they can be used with only a very small volume of air.

The dewpoint apparatus is small and easy to carry ; it can be put anywhere and does not require ventilation or removal of the air.

Amongst other methods of controlling humidity, the author also discusses supersaturated salt solutions, aqueous solutions of potassium hydroxide and mixtures of sulphuric acid and water, together with the appropriate apparatus required to maintain definite conditions.

U. F. RICHARDSON.

MCGRATH, T. T. (1931). **Some Observations on the Treatment of young Sheep for "Lungworm"** (*Dictyocaulus filaria*) **Infestation by Intratracheal Injections.**—*Dept. Agric. New South Wales Vet. Res. Rep. No. 6.* pp. 36-39. 1 table. [1 ref.]

The author reports his observations on the relative values of four different substances as intratracheal injections in the treatment of infestation with *Dictyocaulus filaria*. Nine of the most seriously affected lambs were chosen as test animals from a group which was known, from *post-mortem* examinations made on some of its members, to be harbouring a heavy infestation of this parasite.

Lugol's solution in injections of 3 c.c., repeated on the second and sixth day, caused a severe broncho-pneumonia, but, as was revealed at *post-mortem* examination on the eleventh day, it failed to kill the worms.

Carbon tetrachloride when injected in amounts of 0·25 c.c., given at the same intervals, also caused pneumonia and failed to kill the worms.

Tetrachlorethylene injured the lung, but proved to have a more potent action on the worms. Two lambs received injections of 2 c.c. of pure tetrachlorethylene, repeated on the fifth day, and one lamb received an injection of 1 c.c. of tetrachlorethylene in 2 c.c. of olive oil, repeated on the second and sixth days. In none of these lambs were worms found on *post-mortem* examinations, but where the pure drug was employed the damage to the lungs was extensive.

The mixture recommended by the New South Wales Department of Agriculture was next tried. It contains the following ingredients :—

Turpentine	1 c.c.
Creosote	0·5 c.c.
Olive oil	2 c.c.
Chloroform	0·5 c.c.

Two courses of treatment were tried, one of an injection of 4 c.c., repeated on the second and sixth days, and one of an injection of 2 c.c. repeated on the fifth day, two infected lambs being used for each experiment. On *post-mortem*

examination soon after the completion of the treatments, it was found that the worms had disappeared, presumably having been killed by the drug, and that in all cases the effect on the lungs and bronchi was very slight. It is concluded that the intratracheal injection of this mixture is a safe and effective remedy for infestation with *Dictyocaulus filaria*.

E. L. TAYLOR.

SCHULZ, R. E. (1931). Zur Differentialdiagnose zwischen den Nematoden *Trichostrongylus retortaeformis* (Zeder, 1800) und *T. instabilis* (Railliet, 1893). [**The Differential Diagnosis between** *Trichostrongylus retortaeformis* **and of** *T. instabilis*].—*Deuts. tierärztl. Wschr.* **39.** 439-440. 1 table. 2 figs.

These two species are very similar and, from time to time, doubt has been expressed concerning the difference between them. On examination of several specimens, the author has, however, satisfied himself that the two species are distinct. Up to the present time, *T. retortaeformis* has only been known to occur in hares and rabbits, while, on the other hand, *T. instabilis* has been reported in a number of mammals, principally ruminants, but also in hares and rabbits. Out of 21 hares examined by the author, five were found to be infected with *T. retortaeformis* and four of these were also infected with *T. instabilis*, only one carrying a pure infection of *T. retortaeformis*. Differential diagnosis by host alone is therefore seen to be impossible.

Examination shows that the difference between the two species lies principally in the spicules of the male which, in *T. retortaeformis*, each carry a fine appendage, found to be absent from *T. instabilis*, and in the tail of the female which in *T. retortaeformis* is long and narrow and in *T. instabilis* is short and broad.

E. L. TAYLOR.

I. WOOD, W. A. (1931). **On a New Species of** *Labiostrongylus*.—*First. Rep. Direct. Inst. Anim. Path. Cambridge.* p. 205. [1 ref.] Cambridge: W. Heffer & Sons, Ltd. [Previously published (1929) *Annals and Magazine of Nat. Hist.* (Ser. 10.) **4.** 550.]

II. WOOD, W. A. (1931). **Some New Parasitic Nematodes from Western Australia.**—*Ibid.* pp. 209-219. 10 figs. 1 table. [3 refs.]

III. WOOD, W. A. (1931). **A Note on** *Rugopharynx australis* (**Mönnig,** 1926).—*Ibid.* pp. 206-208. [1 ref.] [Previously published (1929). *Annals and Magazine of Nat. Hist.* (Ser. 10.) **4.** p. 552.]

IV. ORLOFF, I. W., & GNEDINA, M. P. (1931). Ein neuer Nematode *Ostertagia dahurica* nov. sp. aus dem Labmagen des Schafes. [**A New Nematode** *Ostertagia dahurica* **nov. sp. from the Fourth Stomach of the Sheep**].—*Tierärztl. Rdsch.* **37.** 723-725. 5 figs.

I. This second species of the genus *Labiostrongylus*, for which the name *L. longispicularis* is proposed, is described from one male specimen recovered from the stomach contents of *Macropus woodwardi* (a small species of Kangaroo). It differs from *L. labiostrongylus* in that the spicules are more than twice as long and the small ventral and dorsal processes to the mouth collar are absent.

II. In this paper a new species of *Macropostrongylus* is described from some 30 specimens found in the cæcum of *Macropus woodwardi*. The name given to the species is *M. baylisi*. The glandular structure observed by BAYLIS at the junction

of the œsophagus and intestine in the three other members of this genus could not be demonstrated in the new species.

A description is also given of a new species of *Pharyngostrongylus* which is named *P. woodwardi*. The worms from which this species was described were found in the stomach of *Macropus woodwardi*, their heads and the anterior part of their bodies being buried in the mucous membrane.

Three species of *Trichostrongylus* were also found in the stomach and intestines of this same host species, *T. asymmetricus* Cameron, 1926, and two new species named *T. dissimilis* and *T. australis*. CAMERON's original description of *T. asymmetricus* is amended in one or two details and the two new species are described with the aid of figures. [The legends of figs. 8 and 10 appear to have become confused and the scale shown in figs. 7 and 8 presumably represents 0·2 mm. and not 0·1 mm. as stated].

III. The author collected a large number of worms from the stomach of several specimens of the red kangaroo (*Macropus woodwardi*) and, on making an examination of their morphology, concluded that they were of the same species as the nematodes from *Macropus rufus* described by MÖNNIG in 1926 under the name *Spirostrongylus australis*.

In the author's opinion, however, this species is not, as considered by MÖNNIG, referable to the Trichostrongylidæ but to the Trichoneminae, and it appears to belong to the genus *Pharyngostrongylus* Yorke and Maplestone, 1926.

IV. On looking through some material collected from sheep in the Eastern provinces of Russia, two bottles were found to contain what appeared to be a new species of *Ostertagia*. For this species the authors propose the name *O. dahurica* and give a careful description and notes on its differential diagnosis. The new species most closely resembles *O. circumcincta* and *O. orloffi*, but may be distinguished from *O. circumcincta* by the size and structure of the spicules, the main process being much longer than the side process in *O. dahurica*, whereas they are of approximately equal length in *O. circumcincta*. The size and structure of the spicule also differs from that of *O. orloffi*, but the principal difference in this instance is found in the dorsal ray of the bursa, the stem of the ray being much longer than the branches in *O. dahurica*, but a little shorter in *O. orloffi*.

E. L. TAYLOR.

FOURIE, P. J. J. (1931). **The Hæmatology and Pathology of Hæmonchosis in Sheep.**—*17th Rep. Direct. Vet. Ser. & Anim. Indust. Union of S. Africa.* Part I. pp. 495-572. 17 figs, 11 graphs. [39 refs.]

This paper gives an account of a careful and extensive study of the anæmia of hæmonchosis and of its pathogenesis.

The conditions for the observations were made as favourable as possible by using only those lambs which had been experimentally infected with pure fæces-cultures of *Hæmonchus contortus*. It was comparatively easy to produce the typical progressive verminous disease in lambs with a mixed infection of *Hæmonchus contortus*, *Œsophagostomum columbianum*, *Strongyloides papillosus* and *Trichostrongylus spp.*, but attempts made with pure cultures of these parasites often failed; lambs which were kept indoors and given a well-balanced ration seemed to be particularly resistant. The present paper deals only with the observations made on the hæmatology and pathology of hæmonchosis, the report of work on œsophagostomiasis and trichostrongylosis being promised for a later date.

In the course of the experiments on hæmonchosis, 38 worm-free lambs were

experimentally infected with pure fæces-cultures of the larvae. Nine of these lambs developed a fatal progressive anæmia, six developed an anæmia from which they recovered and 23 either resisted infection or did not show any ill effects. A study of the hæmatology of these cases was made by observations on the red cell count, the percentage volume of red cells, the percentage of hæmoglobin, the size of the red cells, the viscosity of the blood, the total white cell count and the differential white cell count. A number of uninfected controls were also examined in the same way.

It is concluded on hæmatological grounds that the anæmia, which is the outstanding pathological effect of *Hæmonchus contortus* infection, is a direct result of the hæmorrhage caused by the attacks of the worms on the mucous membrane of the fourth stomach and that it is identical with the anæmia which can be experimentally produced by frequent bleeding from the jugular vein. This conclusion is supported by evidence that the worms ingest blood and that there is at times comparatively severe hæmorrhage into the alimentary canal, also by the rapidity with which the anæmia appears after a heavy experimental inoculation with the infective larvae of *H. contortus* and disappears when recovery takes place.

In summarising his observations regarding the onset of the anæmia, the author states that the initial effect of the removal of blood where many parasites are present is to stimulate the blood-forming organs to increased activity, resulting in a temporary polycythæmia. Soon, however, there is a progressive decrease in the number of red cells when the bone marrow can no longer meet the enormous demands made upon it, and a compensatory myeloid hyperplasia which also involves the fatty bone marrow takes place. Eventually, a condition is reached in which the blood-forming organs cannot supply sufficient adult cells and immature forms are released into the circulation. This explains the anisocytosis, the polychromasia, the Jolly bodies, the plus volume index (relationship between the total volume of red cells and the number of red cells), the plus colour index (relationship between the amount of hæmoglobin and the volume of red cells) and, probably, also the punctate basophilia which were observed. During the further course of the disease the bone marrow becomes exhausted and degenerative forms, such as poikilocytes and pale cells, make their appearance. [It is interesting that this author, who appears to have been unaware of the work of WELLS, 1930 and 1931, (see this *Bulletin*. **1.** 300.) should have arrived at the same conclusion, from observations made on the host, as that arrived at by WELLS from observations made on the parasite *Ancylostoma caninum* in connection with a similar anæmia in dogs—i.e. that the anæmia of worm diseases of this kind is due solely to the extraction of blood by the worms and to the hæmorrhages which they cause.]

E. L. TAYLOR.

FAIRLEY, N. H. (1931). **Serological and Intradermal Tests in Filariasis.**—*Trans. Soc. Trop. Med. Hyg., London.* **24.** 635-648. 4 tables. [11 refs.]

This preliminary report gives an account of tests on the value of a new complement fixation reaction for the diagnosis of filarial infestation, using an alcoholic extract of *Dirofilaria immitis* as antigen. A detailed account is given of the preparation and standardisation of the antigen and of the technique used in carrying out the test.

Seventy different sera were subjected to the complement fixation test, of which eleven gave positive reactions. Six of the eleven were from persons who proved to be infected with *Loa loa* and four others from persons suffering either

from an active or from a latent infestation with *Wuchereria bancrofti*. Of the 59 negative sera, three were from old cases of *W. bancrofti* infection in which the embryos could no longer be demonstrated, one was from a case of infection with *Onchocerca volvulus*, two others reacted intensively to cercarial antigen in the schistosomiasis test and the remaining 55 patients presented no evidence of filarial infestation.

An intradermal test, using a saline extract of *D. immitis*, an account of which has recently been published by TALIAFERRO and HOFFMAN, is also described. The technique was that used in the author's previous work on hydatid and bilharzia. TALIAFERRO and HOFFMAN's results are confirmed ; good results have been obtained in cases of *Wuchereria bancrofti* infestation and the known use of the test is also extended to *Loa loa* and *Onchocerca volvulus* infestations. A reaction is regarded as positive when a rapidly extending weal appears at the site of inoculation and grows to a diameter of not less than 2·3 cm. in 30 minutes, followed in one to four hours by a larger swelling having a diameter of 4-7 cm. and a depth of 1-3 cm.

Both tests are essentially group reactions and probably include all the filaroid species of the family Filariidae and possibly of Fuelleborniidae.

E. L. TAYLOR.

DISEASES, GENERAL.

FOOY, J. P. (1931). De diagnostische waarde van het Witte bloedbeeld bij malleus en sacharomycosis. **[The Diagnostic Value of the Leucocyte Formula in Glanders and Epizootic Lymphangitis].**—*Tijdschr. Diergeneesk.* **58.** 905-917 & 977-994. 3 tables.

Glanders occurs frequently in the Dutch East Indies and only those animals showing clinical evidence of infection are slaughtered, clinically healthy reactors being allowed to work under police licence. Since mallein tests and serum tests, whether by agglutination or by complement fixation, simply show that an animal is infected and give no indication as to whether the disease is progressive, stationary or even retrogressive, the author has carried out a number of examinations of blood films from horses in different categories of infection for the purpose of determining, if possible, whether changes in the leucocyte formula afford any indication as to the state of disease in the animals. A considerable amount of space is given to a consideration of the views expressed by different authors regarding the normal leucocyte formula of equines.

The author found that, in animals in which the disease is progressive, there is an increase in the number of polynuclear neutrophile leucocytes with, in some cases, myelocytes and young forms ; this increase is accompanied by a reduction in the number of lymphocytes and eosinophils. Examination of the leucocytes is said to afford valuable information in cases where the results of mallein tests and serum tests disagree. It is also said that, in animals recovering from infection, the leucocyte formula gradually becomes normal.

In cases of epizootic lymphangitis the leucocytic formula does not undergo any change.

A. LESLIE SHEATHER.

EDGAR, G. (1931). **Studies in Infectious Ophthalmia of Sheep.**—*Dept. Agric. N.S. Wales Vet. Res. Rep. No. 6.* pp. 22-35. 5 tables, 2 figs. [12 refs.]

The author describes an infectious type of ophthalmia amongst sheep which is comparatively widespread, being most common in summer months. Under

natural conditions, the primary form is an acute conjunctivitis affecting one or both eyes ; at a later stage, a simple keratitis is produced, the cornea becoming quite opaque. In a proportion of cases, a further stage of suppurative keratitis is reached, but resolution often occurs without this complication.

In order to determine whether the condition was infectious, the lacrymal secretion from an affected sheep was instilled into the right eyes of three healthy animals, the left eyes serving as controls. In all cases, a simple keratitis was produced after five days. The infective agent was further transmitted through a series of sheep without any observable decrease in virulence. The disease was infective from the onset of symptoms through all the stages of the condition and was specific for sheep, in particular for the Merino. Horses, cattle, goats, pigs, rabbits, guinea pigs and cross-bred sheep were insusceptible. The condition was also readily transmitted from affected to clean sheep by contact ; it was noticeable, however, that this occurred only when the sheep were grazed on long grass ; it did not occur when they were kept on short pasture. A strong immunity was induced in recovered sheep, but it was strictly localised to an eye which had previously been infected.

A variety of organisms and, in particular, a gram-positive streptobacillus was isolated from affected eyes, but all of them were incapable of setting up the disease in healthy sheep. The passage of lacrymal secretion through Seitz, Berkefeld, Chamberland, F. and plaster of Paris candles failed to reveal a filtrable agent. Dilute lacrymal secretion after centrifugation at 3,000 r.p.m. for two hours yielded a non-infective supernatant portion and an infective deposit. When stored in an ice chest, the secretion was still potent after 48 hours, but was inert at 72 hours.

Experiments which were undertaken on the treatment of the condition indicated that a $2\frac{1}{2}$ per cent. zinc sulphate solution or a 1 per cent. watery solution of iodine were of value.

R. E. GLOVER.

KINSLEY, A. T. (1931). **Swine Diseases Résumé.**—*Vet. Med.* **26.** 402-405.

The author comments on the excessive wastage among very young pigs and the faulty methods of breeding. He describes briefly the clinical appearances of the diseases of swine commonly encountered in the United States. Two types of hæmorrhagic septicæmia are described, the septicæmic and the pulmonary. "Pulmonary œdema," attributed to a pleomorphic streptococcus, is said to be spreading. The remarks on swine erysipelas are interesting : a few years ago nearly all cases (presumably in Missouri) were of the chronic type, but now the acute type is common, though the septicæmic, rapidly fatal form, which occurs in Europe, is rare.

D. A. E. C.

QUIN, A. H. (1931). **A Survey of Certain Diseases of Swine.**—*North Amer. Vet.* **12.** No. 11. 35-43. 2 figs. [14 refs.]

This survey contains notes on several pathological conditions in swine and advice on vaccination against swine fever. Hæmorrhagic dysentery, of which the cause is not known, is described. For the treatment of necrotic enteritis, the author recommends alkaline solutions which are said often to give surprisingly good results.

D. A. E. C.

BARILE, C. (1931). Sulla encefalo-mielite o paralisi dei polli. Nota Preventiva. **[Encephalo-myelitis and Paralysis of Poultry. Preliminary Note].**—*Nuovo Ercol.* **36.** 154-160, 179-181.

The author defines encephalo-myelitis of poultry as a fatal infective and transmissible disease which may occur as an enzootic in which the central nervous system, the alimentary tract and the eyes may all be involved.

A very brief survey of the literature is followed by an account of the clinical symptoms shown by affected birds. Up to the present, no animal or bacterial parasite has been detected, and no intracellular structure has been identified with the disease. The author summarises the lesions—macroscopic and microscopic—which have been described by various authors.

Apparently, only one case of the disease has come under the author's own observation. This bird died about ten days after it was first noticed to be ill, the symptoms exhibited being rigid deflection of the neck, dropping of one of the wings, marked wasting and paralysis. There was also blindness of one eye owing to iritis.

At the *post-mortem* examination which was made immediately after death, the following abnormalities were noted :—slight uniform hyperæmia of the wall of the intestine which was itself somewhat œdematous ; the presence of petechiae ; hyperæmia of the liver and kidneys which were otherwise normal ; increase in the size of the spleen to twice the normal, the parenchyma being dark in colour and rather softer than normal ; hæmorrhagic appearance and diffluence of the marrow of the long bones ; hyperæmia of the ovaries and oviducts ; and enlargement of some of the posterior roots of the spinal nerves and their ganglia, this being particularly noticeable in the neighbourhood of the brachial and lumbo-sacral plexuses.

A considerable amount of space is given to the consideration of differential diagnosis, and a further contribution is promised giving the author's findings regarding the histological examination of the case.

A. LESLIE SHEATHER.

SEELEMANN, M., & HADENFELDT, A. (1931). Zur Frage des Vorkommens und der Bedeutung sogenannter "Dauerausscheider" und "Keimträger" beim gelben Galt. **[On the Question of the Occurrence and Significance of So-Called "Continuous Excreters" and "Carriers" in Chronic Bovine Mastitis].**—*Arch. wiss. prakt. Tierhlk.* **64.** 1-16. 3 charts. 5 tables.

This article is essentially a discussion of the animal which more or less constantly excretes mastitis streptococci and of the most suitable name by which she should be designated. Reference is made to extended observations on many cows.

The authors first plead that the terms "excreter" and "carrier" are much misused. [Contrary to the usual practice in English and American literature, a distinction is made between "excreters" and "carriers."]. The "excreter" is defined as an animal which eliminates streptococci as a result of previous disease although it shows no obvious alteration of the milk ; a "carrier" is defined as one that has never shown evidence of disease. Emphasis is given to the fact that, before either of these terms can be legitimately applied to any particular individual, it is necessary to make observations for a considerable period and that these will frequently show that some degree of mastitis is present. In cases of spontaneous recovery and in cases of cure due to treatment, the authors have only rarely met with animals which continue to excrete streptococci after the

milk has become normal. They conclude that true carriers or continuous excreters of mastitis streptococci, as defined above, are rare.

Their reluctance to use either of these terms is due to the fact that they view cows whose milk contains streptococci, although it is apparently normal, as having had a previous attack associated with alteration of the milk and as likely to show symptoms again. For such animals they suggest a term, the English equivalent of which is "apparent continuous excreter."

Within this category come those cows which, although they have suffered from an attack of mastitis during one lactation, give milk which is normal in appearance during the early part of the succeeding one, although infected with streptococci. Such cases frequently show some alteration in the chloride, catalase or cell content and full details of one representative animal are given.

Analogous details are given of another cow which, after artificial infection, did become a true carrier, streptococci unassociated with any other abnormality being demonstrable for a considerable period.

Details are also given of five other animals which, at several examinations, showed streptococci unassociated with other alterations. Such animals are nevertheless believed to be relatively uncommon. The authors stress the fact that, although mixed samples may be sufficient to demonstrate even a few streptococci, small changes in other characters are likely to be masked. No animal whose milk contains streptococci can be looked upon as healthy or harmless, because but few auxiliary factors are needed to precipitate obvious disease. For the detection of true carriers, cultural methods are imperative.

A. W. STABLEFORTH.

DYKE, S. C., & STEWART, W. (1931). **Blood Platelets in Pernicious Anæmia.**—*Lancet.* **220.** 1080-1082. 6 tables. [2 refs.]

This paper describes five cases of human pernicious anæmia and observations made on the blood platelets before, and during, liver and dried stomach therapy. In the relapse phase of the anæmia, the blood platelets fall to a low level, the lowest level recorded being just over 17,000 per c.mm. With an improvement in the blood picture due either to liver or to dried stomach treatment, the platelets rise rapidly in number. It is considered that anæmia of the pernicious type is not due simply to destruction of the red cells, but that it is an expression of a morbid state affecting the whole of the hæmatopoietic system. The effect of the treatment by liver or desiccated stomach is not confined to the red cell-producing portions of the hæmatopoietic system, but is active over the whole of it. The rise in blood platelets may give rise to thrombotic accidents.

J. R. M. INNES.

TAPERNOUX, A., & DIDIER, S. A. (1931). Un cas de sclérose musculaire généralisée chez le veau de boucherie. [**A Case of Generalised Muscular Sclerosis in a slaughtered Calf**].—*Rev. gén. Méd. vét.* **40.** 7-14. 2 plates. [7 refs.]

A single case of this generalised myopathy is described in a six weeks' old calf. The macroscopic and microscopic appearances are described. The muscles mainly involved were those of the limbs; other organs were normal. Fatty degeneration was not part of the pathological process and bacterial examination did not reveal the presence of any causal organism.

J. R. M. INNES.

LACASSAGNE, A. (1931). Sur l'absence de fixation élective du radium E associé au bismuth, dans les cellules cancéreuses de souris atteintes d'épithelioma spontané. [**The Absence of Selective Retention of Radium E mixed with Bismuth by Cancer Cells of Mice bearing Spontaneous Epithelioma**].—*C.R. Soc. Biol. Paris.* **107.** 458-461. 1 plate. [6 refs.]

LACASSAGNE, A., & LOISELEUR, J. (1931). Sur l'absence de fixation élective du bismuth dans les tumeurs cancéreuses. [**The Absence of Selective Retention of Bismuth by Cancers**].—*Ibid.* 462-464. 1 table. [4 refs.]

Neither radium E nor bismuth is selectively retained by tumour tissue, as a number of previous workers have reported. In fact, tumour tissue appears to retain these substances in a lesser concentration than do normal tissues, e.g. those of the kidney, spleen and liver. The experiments with the bismuth-radium E mixture were carried out with "Bi-diasporal 360 radioactif," which is a colloidal solution of bismuth combined with radium E in a solution of isotonic glucose. Six mice with spontaneous mammary tumours were used and the tissues were examined histologically. A warning is given against examining the tissues before all the β rays have escaped from them, as erroneous conclusions may otherwise be drawn. The bismuth results were obtained from the above six animals, from three mice injected with an ammonical solution of bismuth citrate and from three experimental rabbits. The quantity of bismuth in the tissues was estimated colorimetrically by the iodide method of GIRARD and FOURNEAU. One mouse injected with the bismuth citrate gave a slightly greater content of bismuth in the tumour tissue than in liver tissue.

W. R. WOOLDRIDGE.

NICHOLSON, G. W. (1931). **An Embryonic Tumour of the Kidney in a Fœtus.** —*J. Path. Bact.* **34.** 711-730. 6 figs. on 2 plates. [52 refs.]

This is an account of a tumour of the kidney in a human fœtus (stillborn, full term) which retained the structure of the developing organ to an unusual extent, thereby allowing a histogenetic comparison. A detailed anatomical and histological description is given. The main histological findings included (a) tubules and (b) glomeruli in all stages of development. Some of the latter showed distended capillaries, others were hyaline and some were deformed and enclosed in cystic capsules. The capsule of the tumour consisted of a thin layer of fibrous tissue with many atrophic glomeruli representing a compressed renal cortex.

The literature concerning these embryonic tumours is reviewed in detail. The cellular parenchyma, tubules and glomeruli proved it to be of a simple type (without extraneous tissues such as skeletal muscle, adipose tissue, cartilage and squamous epithelium). It is considered by the author that this type of tumour is truly metanephric and essentially a malformation. (GRAWITZ (1883) considered that the *strumae suprarenales aberratae renum* were of suprarenal origin, a theory that is widely held at the present day and has been applied to these embryonic tumours of infants, that is that they are of mesonephric origin). The glomeruli are constituents of the tumour and not the remains of kidney infiltrated by it, the typical Malpighian corpuscles alone justifying the conclusion that the metanephrogenic part of the kidney is represented in the tumour. The tubules fall short of the Malpighian corpuscles in differentiation, the secretory tubules not proceeding beyond the formation of lumina, a few sacculations and bends, and rudimentary loops of Henle, all ending blindly below. The collecting tubules form a closed system not communicating with the secretory tubules;

their differentiation is not as perfect as the Malpighian corpuscles but exceeds that of the secretory tubules.

The tumour represents a piece of developing kidney which has persisted at an embryonic stage. Growth is continuous and imperfect and differentiation is abortive and incomplete. It does not grow " without any regard for the laws which govern and restrain normal tissue growth " as stated by McCallum (1921), but " without subserving any useful function " as shown by Powell-White (1900). [Definition of neoplastic growth.] From the moment differentiation begins, pathological blastomatous growth ceases and it then approaches the physiological type. The greater the tendency towards anaplasia the more malignant a tumour becomes.

Viewed as a malformation, the tumour represents the development of a normal tissue of the embryo after abnormal stimulation, while the surrounding kidney represents growth after normal stimulation. There is no reason to suppose that the physiological rate of growth of the blastema of the normal kidney was exceeded at any time.

If no new unphysiological properties are acquired in any pathological process and if tumour formation is simply an expression of a natural physiological function, in response to a pathological process, of any cell capable of division, no advance can be made until the stimuli responsible for physiological growth, differentiation and development are known and understood.

Every tumour, like every physiological organ, is truly congenital and truly acquired, whether it arises in an embryo as a reaction to an unknown stimulus or in a centenarian as a reaction to a known irritant. The reaction is innate in either case, being congenital and physiological, the stimulus alone being extraneous, acquired and pathological.

J. R. M. INNES.

Hill, Leonard. (1931). **Spontaneous Tumours in Mice. Influence of Diet and Age.**—*Lancet.* **220.** 966-969. 2 tables. [30 refs.]

The relation of diet to cancer in the human being is discussed. " There is no reliable evidence, experimental, statistical, or clinical which would indicate a causal relationship between cancer and the absence, the presence, or excess of any particular dietary constituent " (*Rep. Imp. Cancer Res. Fund*). To study the influence, if any, of age and diet, stocks of mice were maintained, bred from and kept going for six years. The mice in each successive stock were kept until they died naturally, excepting those with obvious tumours ; autopsies were carried out on all mice. Microscopical preparations were made of all tumours and histological diagnoses were made.

The significant factor was age. Two per cent. of the tumours occurred in mice dying under one year of age ; 8 per cent. in those dying between one and one and a half years ; 40 per cent. in those dying between one and a half and two years ; 34 per cent. in those dying between two and two and a half years ; and 16 per cent. in those dying between two and a half and three years. A total of 793 mice was examined, 400 males and 393 females. Among these mice, there occurred :—140 lung tumours, 76 mammary carcinomas, 29 liver tumours, 23 lymphomata, three thyroid tumours and a few tumours of the ovary, testis and bowel, also a few epitheliomata, totalling in all 303 ; 31 per cent. occurred in the males and 49 per cent. in the females.

No obvious source of irritation was found and diet had no apparent significant influence on the incidence ; tumours occurred indifferently in mice kept on every kind of diet used on different kinds of bedding.

J. R. M. INNES.

SUSMAN, W. (1931). **The Rôle of the Pituitary in the Etiology of Cancer.**—*Brit. Med. J.* Oct. 31st. 794-798. 1 table, 1 chart, 8 figs. on 2 plates. [9 refs.]

ZONDEK (1930) showed that, in certain neoplastic diseases, anterior pituitary activity was increased to an appreciable degree in a significant proportion of cases as evidenced by the presence of the hormone (gonad-stimulating) in the urine. A similar activity also occurs in pregnancy, but, in the latter, tissue growth (the developing fœtus) is controlled while, in malignant processes, it is not. [The source of the hormone in the urine has not been conclusively proved to be hypophyseal in origin.]

Histological examination of 230 pituitaries, 30 of which were from cases of malignant disease, showed that the anterior lobe exhibited evidence of a higher degree of activity than the normal and that, in the cancerous cases, it was probably stimulating tumour formation. [The evidence is controversial.] The lesions of the posterior lobe indicated that the quality and quantity of the secretion was affected in cancer cases and that the growth-restraining influence was thus lost. Changes were also observed in the cell islets of Langerhans in the pancreas. It is suggested that there exists an unbalanced state in several of the ductless glands which permits the development of the neoplasm, the important points being :—(1) over-activity of the anterior pituitary ; (2) under-activity of the posterior pituitary ; and (3) an increased demand for carbohydrate, giving rise to abundant and enlarged islets of Langerhans.

The experimental production in mice of tumours induced by shale oil applications showed that an abundant supply of glucose promoted the development of epitheliomata. Subsequent treatment by pituitrin injections of the mice in which tumours were present showed that this treatment had some inhibitory effect (in comparison with suitable controls) on the tumour growth, complete cure resulting in some cases.

Cases of carcinoma in the human being were treated on the lines indicated by these conceptions, i.e. with a low carbohydrate diet and pituitrin injections. In one group (four cases) in which neoplastic growth was advanced (two patients died), it was considered that all the growths showed signs of definite regression. In another group, (five cases), in addition to the low carbohydrate diet and pituitrin injections, theelin injections were given to restrain over-activity of the anterior lobe. In all cases, regression of the tumour growth occurred and improvement of the general health of the patient followed. Case reports are given.

J. R. M. INNES.

DURAN-REYNALS, F. (1931). **The Effects of Testicle Extract and of Normal Serum on a Transplantable Epithelial Tumour of the Rabbit.**—*J. Exp. Med.* **54.** 493-498. 3 tables, 4 figs. on 2 plates. [15 refs.]

A factor exists in rat, rabbit, or bull testicle extracts which prevents or retards the growth of a transplantable rabbit epithelioma when a mixture of the extract and tumour cell suspension is inoculated intradermally. The Brown-Pearce epithelioma of the rabbit, a tumour having its origin in the hair sheaths of the scrotum, was used in these experiments. Similar mixtures made with normal rabbit serum, instead of with testicle extract, gave rise to tumours which grew with unusual rapidity. These results are contrary to those obtained with pathogenic bacteria or filtrable viruses, the potency of which is enhanced by testicle extract and generally inhibited by normal serum.

J. R. M. INNES.

HUTCHISON, J. K. (1931). **Some Observations on Avitaminosis A in Fowls.**—*Austral. Vet. J.* **7.** 93-98. [3 refs.]

BRANDLY, C. A. (1931). **Nutritional Diseases of Poultry.**—*North Amer. Vet.* **12.** No. 12. 45-48. [5 refs.]

The first paper describes an outbreak of disease in fowls which was considered to be due to vitamin A deficiency. Experiments were conducted and it was proved that this avitaminosis could be produced in birds fed on cereal mash and wheat, while the addition of green feed or cod-liver oil prevented or cured the condition. It was more easily induced in adult fowls than in chicks.

The second paper is of interest to the practitioner and deals very briefly with certain avitaminoses of poultry occurring under natural conditions (vitamins A, B and D deficiencies). The lesions of avitaminosis A are described, typical keratinisation changes (as described by SEIFRIED, 1930) being observed in the respiratory, alimentary and urinary systems.

J. R. M. INNES.

MOORE, R. A., & BARLOW, O. W. (1931). **Histological Studies of the Bone Marrow in Fasted and Polyneuritic Pigeons.**—*J. Exp. Med.* **54.** 761-765. 2 tables, 3 figs. on 2 plates. [2 refs.]

The authors describe the histological changes in the bone marrow of pigeons suffering from experimental disease due to feeding on rice and compare them with the effects of starvation and pure vitamin B [? complex] deficiency. For this purpose, six pigeons were fed on a normal diet and used as controls ; 11 others were deprived of food until they had lost 40 to 50 per cent. of their weight ; 12 were fed on polished rice until a similar weight was lost ; and seven were fed on a synthetic vitamin B deficient diet. After death, pieces of the bone marrow of the radii of all the birds were fixed in Zenker, embedded in paraffin and examined histologically.

Little difference was observed in the percentage loss of body weight, red blood cell count, hæmoglobin content and bacterial count of the marrows of the rice-fed series and ordinary fasting birds ; in the latter, erythrogenesis and fat replacement were almost in abeyance and a marked increase in the hæmatopoietic elements had occurred. These changes were strictly comparable with those found in the rice-fed series. In pure vitamin B deficiency, the marrow change was different. Hæmatopoiesis of both the granular and red cell series was abundant in all the stages, but many adult and immature cells showed evidence of degeneration. Oedema of the walls of the arterioles and venules and swelling and proliferation of the endothelium were also present.

The conclusion is that the anæmia of rice disease is essentially a starvation anæmia and not related in any way to the absence of vitamin B in the rice. (Polished rice is also deficient in other factors.) [It has frequently been shown that, although many lesions have been described in connection with vitamin B deficiency, few, if any, are specific for this avitaminosis.]

J. R. M. INNES.

GILROY, E. (1931). **The Vitamin B Content of Commercial Liver Extracts and Stomach Preparations.**—*Lancet.* **221.** 1093-1098. 4 figs. [35 refs.]

Young rats were fed on diets deficient in the water soluble vitamins till they showed symptoms due to the lack of vitamins B_1 and B_2, when samples of commercial liver extracts or stomach extracts were added to the diet. Excellent

growth resulted from the addition of nine out of the eleven commercial preparations, and of three out of the four stomach preparations used, in amounts equivalent to 16 g. of fresh liver. It is concluded that liver and stomach preparations, as used in the treatment of pernicious anæmia, are naturally rich in vitamins B_1 and B_2. The dose of liver extract sufficient for maintenance in the normal, unmated, adult animal is inadequate during pregnancy and it is possible that premature births and other morbid phenomena may be associated with a relative deficiency in vitamin B.

The significance of the antineuritic factor of the vitamin B complex in the ætiology of certain types of pernicious anæmia is discussed with reference both to recent clinical observations and to other results obtained from liver treatment.

W. R. WOOLDRIDGE.

I. MALAN, A. I., & BEKKER, J. G. (1931). **Studies in Mineral Metabolism. 14. Inorganic Phosphorus in the Blood of Pregnant Heifers.** *17th Rep. Dir. Vet. Ser. & Anim. Indust., Union of S. Africa,* Part II. pp. 433-438. 1 table, 1 chart. [5 refs.] Pretoria : Govt. Printer.

II. MALAN, A. I. (1931). **Studies in Mineral Metabolism. 15. Potassium Iodide in Poultry Farming.**—*Ibid.* pp. 439-442. 4 tables. [3 refs.]

III. MALAN, A. I., & v.d. LINGEN, G. W. B. (1931). **Studies in Mineral Metabolism. 16. The Micro-Determination of Some Inorganic Elements in Blood and Grasses.**—*Ibid.* pp. 443-452. 1 fig., 2 tables. [11 refs.]

IV. DU TOIT, P. J., MALAN, A. I., & GROENEWALD, J. W. (1931). **Studies in Mineral Metabolism. 17. Phosphorus in the Nutrition of Sheep.**—*Ibid.* pp. 453-472. 9 charts, 4 tables, 5 plates. [3 refs.]

V. v.d. LINGEN, G. W. B. (1931). **The Effect of Small Quantities of Nitric Acid on the Colorimetric Determination of Phosphorus.**—*Ibid.* pp. 475-477. 1 chart, 2 tables. [1 ref.]

VI. v.d. LINGEN, G. W. B. (1931). **The Increase of Inorganic Phosphorus in Blood containing Lithium Citrate as Anticoagulant.**—*Ibid.* pp. 479-480. 1 chart, 2 tables. [3 refs.]

[*The following are earlier papers in the same series, and cognate papers from the same team of workers, arranged in sequence down to 1920, and inserted for the purpose of reviewing the later papers in proper perspective.*]

VII. DU TOIT, P. J., & GREEN, H. H. (1930). **Dicalcium Phosphate as a Source of Phosphorus in Nutrition.**—*16th Rep. Dir. Vet. Ser. & Anim. Indust., Union of S. Africa.* Part I. pp. 267-285. 6 charts, 1 table. [2 refs.] Pretoria : Govt. Printer.

VIII. MALAN, A. I. (1930). **The Increase of Inorganic Phosphorus due to Hydrolysis in Solutions of Blood.**—*Ibid.* pp. 287-292. 3 tables. [2 refs.]

IX. BEKKER, J. G., & ROSSOUW, S. D. (1930). **A Note on Some Conditions in Sheep in the Strandveld of the Bredasdorp District.**—*Ibid.* pp. 293-300. 3 plates, 3 tables. [4 refs.]

X. MALAN, A. I. (1930). **Studies in Mineral Metabolism. 13. The Phosphorus Partition of the Blood of some Animals.**—*Ibid.* pp. 327-328. 2 tables. [6 refs.]

XI. DU TOIT, P. J., MALAN, A. I., & ROSSOUW, S. D. (1930). **Studies in Mineral Metabolism. 12. Phosphorus in the Sheep Industry. Preliminary Report.**—*Ibid.* pp. 313-326. 4 tables. [15 refs.]

XII. MALAN, A. I. (1930). **Studies in Mineral Metabolism. 11. Mineral Metabolism and Blood Analysis.**—*Ibid.* pp. 307-311. 1 table. [9 refs.]

XIII. ROSSOUW, S. D. (1930). **Studies in Mineral Metabolism. 10. The Effect of Bone Meal on the Phosphorus Partition of the Blood of Sheep.** —*Ibid.* pp. 301-306. 6 tables. [2 refs.]

XIV. ROBINSON, E. M. (1930). **The Bacteria of the** *Clostridium Botulinum* **C and D Types.**—*Ibid.* pp. 107-142. 39 tables. [41 refs.]

XV. ROBINSON, E. M. (1929). **Notes on Botulism in the Domesticated Animals.**—*15th Rep. Dir. Vet. Ser., Union of S. Africa.* Vol. I. pp. 97-110. 23 tables. [7 refs.] Pretoria : Govt. Printer.

XVI. SCHEUBER, J. (1929). **A Note on Investigations into the Distribution of the Lamsiekte Organism** (*Cl. parabot. C type*).—*Ibid.* pp. 223-226. [2 refs.]

XVII. DU TOIT, P. J., & BISSCHOP, J. H. R. (1929). **The Breeding of Cattle on Phosphorus Deficient Veld.**—*Ibid.* Vol. II. pp. 1059-1166. 71 figs., 14 charts, 27 tables. [9 refs.]

XVIII. MALAN, A. I. (1928). **Studies in Mineral Metabolism. 9. The Phosphorus Partition of Blood in Anæmia of Cattle and Sheep.**—*J. Agric. Sci.* **18.** 401-405. 4 tables. [1 ref.]

XIX. MALAN, A. I. (1928). **Studies in Mineral Metabolism. 8. Comparison of Phosphorus Partition in the Blood of Calf Fœtus, Sheep Fœtus, and Lambs, with corresponding Maternal Blood.**—*Ibid.* 397-400. 1 table. [8 refs.]

XX. MALAN, A. I., & GREEN, H. H. (1928). **Studies in Mineral Metabolism. 7. The Unknown Phosphorus Fraction of Calf Blood.**—*Ibid.* 391-396. 2 tables. [11 refs.]

XXI. GREEN, H. H., & MACASKILL, E. H. (1928). **Studies in Mineral Metabolism. 6. Comparison of the Blood of Cow and Calf in Respect to Mineral Constituents.**—*Ibid.* 384-390. 2 tables. [4 refs.]

XXII. MALAN, A. I., GREEN, H. H., & DU TOIT, P. J. (1928). **Studies in Mineral Metabolism. 5. Composition of Bovine Blood on Phosphorus Deficient Pasture.**—*Ibid.* 376-383. 3 tables. [4 refs.]

XXIII. GREEN, H. H. (1928). **Studies in Mineral Metabolism. 4. Determination of Phosphorus Compounds in Blood by Dry Combustion.**—*Ibid.* 372-375. [8 refs.]

XXIV. THEILER, A., GREEN, H. H., & DU TOIT, P. J. (1928). **Studies in Mineral Metabolism. 3. Breeding of Cattle on Phosphorus Deficient Pasture.**—*Ibid.* 369-371. [2 refs.]

XXV. VAN ZYL, J. P. (1928). **Soil Conditions in Typical Lamsiekte and Styfsiekte Soils, as revealed by Pot Cultures.**—*13th & 14th Rep. Dir. Vet. Educ. & Res., Union of S. Africa.* Part II. pp. 993-1036. 2 charts, 12 plates, 14 tables. [69 refs.] Pretoria : Govt. Printer.

XXVI. HENRICI, Marguerite. (1928). **The Phosphorus Content of the Grasses of Bechuanaland in the Course of their Development.**—*Ibid.* pp. 1077-1208. 51 charts, 53 tables. [24 refs.]

XXVII. Henrici, Marguerite. (1928). **The Relations between the Amount of Carbohydrates in the Leaves of Armoedsvlakte Grasses and the Meterological Factors.**—*Ibid.* pp. 1041-1074. 12 charts, 12 tables. [23 refs.]

XXVIII. Theiler, A., Green, H. H., & du Toit, P. J. (1927). **Minimum Mineral Requirements of Cattle.**—*J. Agric. Sci.* 17. 291-314. 6 plates, 3 tables. [14 refs.]

XXIX. Theiler, A. (1927), in association with Viljoen, P. R., Green, H. H., du Toit, P. J., Meier, H., & Robinson, E. M. **Lamsiekte (Parabotulism) in Cattle in South Africa.**—*11th & 12th Reps. Dir. Vet. Educ. & Res., Union of S. Africa.* Part II. pp. 821-1361. 1 diagram, 19 figs., 104 tables, 13 charts. [7 refs.] Pretoria : Govt. Printer.

XXX. Henrici, Marguerite. (1926). **Physiological Plant Studies in South Africa. Part I. Wilting and Osmatic Phenomena of Grasses and other Plants under Arid Conditions. Part 2. Transpiration of Grasses and other Plants under Arid Conditions.**—*Ibid.* Part I. pp. 617-702. 20 photographs, 10 charts, 17 tables. [50 refs.]

XXXI. Henrici, Marguerite. (1926). **The Chlorophyll Content of Grasses in Bechuanaland.**—*Ibid.* pp. 259-271. 5 tables, 4 charts. [11 refs.]

XXXII. Green, H. H. (1925). **Perverted Appetities.**—*Physiol. Rev.* 5. 336-348. [14 refs.]

XXXIII. Theiler, A., Green, H. H., & du Toit, P. J. (1924). **Phosphorus in the Live Stock Industry.**—*J. Dept. Agric., Union of S. Africa.* 8. 460-504. 2 tables, 30 figs.

XXXIV. Theiler, A. (1920). **The Cause and Prevention of Lamziekte.** (Being results of Investigations undertaken by Theiler, A., Viljoen, P. R., Green, H. H., du Toit, P. J., & Meier, H.)—*Ibid.* 1. 221-224.

The group of six papers published in the Onderstepoort Report dated August, 1931, represents a miscellaneous assortment of investigations bearing, directly or indirectly, upon mineral requirements of the domesticated animals—in particular upon the question of aphosphorosis and diseases associated with mineral deficiencies.

As indicated by the title of the fourth paper, the series " Studies in Mineral Metabolism " has now reached number 17, but even this number does not cover the entire group and many collateral papers have been written under other titles. To understand their *raison d'être* and set them in proper perspective, it is necessary to hark back about a decade to the period following the enunciation of the cause of the disease " lamsiekte." For this reason references are given to the chief earlier papers on allied topics from the same laboratories. The connecting links become apparent if the list is abstracted in approximately chronological order—reverse numerical order.

The paper by Theiler [34] on the cause and prevention of lamsiekte [a fatal disease of cattle known to the earliest settlers in South Africa] marks the first clear enunciation of the connection between death due to ingestion of carcass debris infected with toxicogenic saprophytes (*Cl. botulinum* types), and mineral deficiency of the pastures on which the cattle contract the disease.

Earlier workers, notably Hutcheon (Reports Veterinary Surgeon, Cape of Good Hope, years 1882-1895) had predicated a connection between mineral deficiencies and " lamsiekte " (although never suspecting botulism) but even in 1915 when Theiler, Green and Viljoen published their " Contribution to the

Study of Deficiency Disease with Special Reference to the Lamsiekte Problem in South Africa " [third and fourth Reports of Director of Veterinary Research, Union of S. Africa] the etiology of the disease was quite obscure. Although that paper did refer to the intention of investigating mineral requirements of stock in relation to skeletal diseases [p. 63], it is chiefly noteworthy as having eliminated the possibility of an avitaminosis in grazing cattle and establishing for the first time the exceedingly low exogenous requirements of bovines in respect to vitamins (rice feeding experiments).

Certain earlier papers had come astonishingly close to the immediate cause of " lamsiekte " and there is no doubt that many of the cases of so-called " toxæmia " produced by KEELING ROBERTS in 1909, by WALKER about the same date [(1912). *2nd Report, Director of Veterinary Research, Union of S. Africa.*], by MITCHELL, by ANDREWS, by DE KOCK, and by THEILER himself, prior to 1916, were unquestionably genuine " lamsiekte." Indeed DE KOCK [quoted VILJOEN (1918). *5th and 6th Reports, Director of Veterinary Research, Union of S. Africa.* p. 297 and table 6.] produced six cases during November and December, 1914, by drenching minced muscle from " lamsiekte " carcasses to healthy cattle, and recorded the diagnosis " lamsiekte ? " Nevertheless VILJOEN (1918) still supported the earlier " grass toxin " theory of THEILER (p. 317) although THEILER in a footnote dated May, 1919, puts forward his later explanation. In regard to HUTCHEON's earlier association of " lamsiekte " with pica, VILJOEN did not record osteophagia and indeed writes (p. 263) " On Armoedsvlakte an excessive craving for bones has not been noticed and, in fact, in one small paddock where carcasses were strewn broadcast we had great difficulty in getting animals to chew the bones " [probably a question of stage of putrefaction of carcass debris].

A year later Theiler strongly emphasised osteophagia on the same farm [probably " sweeter " or more weathered debris], effected a final coördination with the earlier observations on the so-called toxæmia produced in the drenching experiments, observed the disease actually developing after natural ingestion of carcass debris, and offered a complete solution to this " riddle of the veld." Paper 34 of the title list gives his preliminary statement and includes the results of supplementary observations by Viljoen, Green, du Toit, and Meier.

Using recent terminology the solution may be stated as follows :—

(1) Cattle grazing over a phosphorus deficient pasture develop an aphosphorosis, one of the earliest clinical manifestations of which is generally osteophagia.

(2) Such cattle become carnivorous in respect to skeletal debris, an abundance of which is often present on sparsely inhabited veld (animals dying from any cause —including game, birds, tortoises, lizards).

(3) If accessible skeletal debris happens to be infected with saprophytes capable of producing toxin (*Cl. botulinum*) it becomes exceedingly poisonous and if cattle ingest this, in their attempts to alleviate aphosphorosis by bone-eating, they die of " lamsiekte."

It will be observed that the simultaneous occurrence of three factors is necessary for the production of the naturally occurring disease—a protein substrate for toxin production (carcass debris), the presence of species of *Cl. botulinum* and phosphorus deficiency of pasture. If any one of these is missing " lamsiekte " does not occur, and theoretically the disease can be controlled either by removing the substrate for toxin production (hygienic disposal of carcasses and clearing the veld of small debris) or by removing the aphosphorosis (feeding sterilised bone meal). In practice Theiler recommends both measures.

[This paper (34) was the starting point for all the subsequent work by the

various authors mentioned in the list of papers culminating in the recent 1931 issues. That Theiler's own interest in the problem survived his retiral from Onderstepoort, is indicated by his paper before the Centenary Meeting of the British Association in September, 1931 (see this *Bulletin*. **1.** 313; also **2.** 101.).]

In testing for osteophagia as a common premonitory symptom of aphosphorosis, Theiler adopted the device of exposing test bones within reach of the cattle—" sweet " or bleached bones to indicate slight osteophagia, and " slightly putrid," or distinctly odoriferous, to detect marked osteophagia.

In paper 33, Theiler, Green and du Toit develop the thesis more fully and show that, quite apart from the " lamsiekte " aspect of aphosphorosis, the mineral deficiency (specifically phosphorus and not calcium) of the pastures over wide areas of South Africa leads to serious economic losses from general malnutrition. This paper connects phosphorus deficiency of soil and vegetation with stunted growth of cattle, late maturity, reduced calf crop, and low milk yield. It adumbrates the later explanation (28) of the disease " styfsiekte " [osteomalacia and rickets—see THEILER, this *Bulletin*. **1.** 313.] as a straight aphosphorosis with an independent mortality incidence. The article is written in a semi-popular vein, profusely illustrated with photographs showing the various phases of phosphorus deficiency in cattle, and with graphs showing the gains in live-weight following rectification of the deficiency by bone-meal feeding. Various other points are discussed, such as the influence of phosphorus deficiency upon appetite, seasonal variation of phosphorus in pasture grass, soil deficiencies as reflected by pot experiments and by manuring the pasture, and methods of administration of phosphorus. The most striking feature of the work is the demonstration that it is highly profitable to feed bone meal irrespective of disease incidence, and this marks the turning point of the investigations from the strictly pathological path into wider channels embracing animal husbandry.

Paper 32 is a review article by Green, published in America, drawing the attention of physiologists to bovine osteophagia as perhaps the most specific known form of perverted appetite—a form for which the physiological cause is more readily grasped than in the case of *anorexia nervosa*, bulimia, hair licking, wool eating, feather eating, egg eating, " lecksucht," coprophagia, arsenophagia, and pica in its various other guises (drug pica, allotriophagia of chlorosis and in the insane).

Papers 31, 30, 27, and 26, by Marguerite Henrici, represent an expansion of Theiler's ideas in the direction of plant physiology. They are interesting as studies of the physiological behaviour of the natural vegetation on the arid farm Armoedsvlakte, upon which so much of the " lamsiekte " research was carried out. In paper 26 she deals more specifically with the main theme and traces the phosphorus content of veld grasses in the course of their development—dealing separately with leaves, roots, haulms and spikes. She discusses migrations of phosphorus in indigenous grasses and the influence of aphosphorosis in the plant upon bad seeding.

Paper 25, by van Zyl, treats " lamsiekte " and " styfsiekte " soils from the point of view of the agricultural chemist. Comparing the soils of Armoedsvlakte (" lamsiekte "), Shepstone (typical " styfsiekte ") and Verona (border-line) he sums up by saying that " a good crop can be produced on the Shepstone soil only if suitable fertiliser is applied and a high soil moisture maintained, whereas the Armoedsvlakte soil needs proper fertiliser equally badly but does not require a high moisture content, and the Verona soil does not stand in immediate need of any fertilising element although it requires a high soil moisture level."

Paper 29 gives the protocols omitted in papers 34 and 33—about 440 pages, many of them in small print (*post-mortem* examinations) and many consisting of tabulated data. It is divided into sections written up by the various collaborators (Theiler, Viljoen, Green, du Toit, Meier, and Robinson) under the general guidance of the Director of Veterinary Research. Pages 822-851 cover an introductory review surveying the work as a whole. Pages 843-851 give historical notes dating from the travels of Le Vaillant in 1785 up to the " formulation of the truth as a coherent whole " in 1919. Pages 851-1051 deal with the lamsiekte toxin and experiments on immunity ; pages 1201-1211 with the isolation and description of the toxicogenic saprophyte (marking the entry of E. M. Robinson into the team of collaborators, following the less specific isolations of Fourie and Andrews). Pages 1211-1248 and 1307-1361 deal with osteophagia and phosphorus deficiency in relation to " lamsiekte." Pages 1248-1292 discuss symptomatology of " lamsiekte " and pages 1292-1306 cover pathology and pathogenesis.

Paper 28 was published in Britain, partly to arouse the interest of agriculturalists in veterinary problems. It is the gist of the paper read by du Toit at the Oxford meeting of the British Association for the Advancement of Science, in 1926, on behalf of the authors Theiler, Green, and du Toit. It is dominantly biochemical in tone, the more strictly pathological aspects being dealt with by Theiler at a later date [see this *Bulletin*. **1.** 313. and **2.** 101.], and it breaks a lance with Marek [" Wesen, gegenseitige Beziehung und Therapie der Rachitis, der Osteomalacia, und der Osteoporose." *Arch. f. Thierhlk.* **51.** 1.] on the question of Ca/P ratios. The authors disagree with Marek and Ibele on the significance of " alkali-alkalizität " and " erdalkali-alkalizität," but the main interest of the paper lies in the experimental production of a clear-cut bovine aphosphorosis for the first time and the establishment of its identity with the naturally occurring " styfsiekte." Together with paper 33 (p. 44) it establishes the proof that this economically important disease is a straight aphosphorosis in extreme form—the syndrome running :—hypophosphoræmia, osteophagia, osteoporosis, osteomalacia, rickets (if epiphyses still open), cachexia, *exitus*.

The blood analyses in this paper show a drop of " inorganic phosphorus " long before clinical symptoms appear, and adumbrate a diagnostic method for aphosphorosis in its earlier malnutritional stages. A further point of interest is the ease with which an aphosphorosis can be produced, as compared with the difficulty of inducing an alcalcicosis even when the calcium in the ration is reduced below 10 g. CaO per day.

In paper 24, the same three authors deal with the breeding of cattle on phosphorus deficient areas, again publishing in Britain as " Studies in Mineral Metabolism 3 " with a footnote explaining that the preceding paper (28) is to be taken as number 2 of the series, and the paper " Phosphorus in the Live Stock Industry " as number 1. On the sentimental side the note foreshadows the retiral of Sir Arnold Theiler and the continuation of the work by his numerous disciples. On the scientific side the paper shows that on the arid, sparse, phosphorus-deficient pasture of Armoedsvlakte (Vryburg, C. P.) with its carrying capacity of only one beast to about 16 acres, the grading up of scrub cattle, by combining phosphorus feeding with the introduction of pure bred bulls, can be made an economic success.

Remarkable differences in favour of bone meal supplement are shown in respect to reduced mortality, increased fertility, and superior development of calves. Without phosphorus supplement the area is shown to be worthless for cattle rearing—of the " control cattle " on the farm in 1925 only 47 per cent. remained alive in 1927. With phosphorus supplement fertility rose from 51

per cent. to 80 per cent. (of possible calf crop), character of calves improved, and the first generation of cross-breds weighed, when 15 months old, nearly twice as much as the calves of " scrub control parents."

Paper 22 reveals the mantle of Theiler on the shoulders of du Toit, and the entry of Malan into the team. The chief features of the paper are the analyses by Malan of the blood of the cattle in the main experiments of du Toit and Green. The outstanding feature is the low inorganic phosphorus of the naturally grazing cattle, as compared with the cattle receiving bone meal (drop from normal of 5 mg. per 100 c.c. to below 1 mg. in some cases), combined with relatively normal " lipoid phosphorus " and normal blood calcium. The ease with which aphosphorosis can be detected by blood analysis is demonstrated, and upon this du Toit has planned a survey of the deficient pastures of the Union through the blood of stock grazing over them (see later papers).

In paper 21 by Green and Macaskill, the latter provides figures for the blood of cow and calf in respect to Ca, Mg, K, Na, and Cl, as well as total P, lipoid P, organic acid-soluble P, and inorganic P.

Paper 20 by Malan and Green deals with a small nucleo-protein fraction occasionally present in calf blood, and paper 18 by Malan associates this unusual fraction with the appearance of normoblasts and Jolly bodies in diseased blood of cattle and sheep.

Paper 7 by du Toit and Green marks the disappearance of Green from the team. Its object is mainly economic and it shows that dicalcium phosphate (precipitated phosphate, bye-product from gelatine production) is an efficient substitute for bone meal in cattle nutrition, giving equivalent results at half the cost.

Paper 17 by du Toit and Bisschop is a long contribution of 107 pages liberally illustrated with photographs and charts. Again the scene is Armoedsvlakte and results of striking economic importance emerge. The salient features are :—

(a) Demonstration of the remarkable effect of phosphorus supplement on fertility of cows. Of 109 " bone meal cows " which remained in experiment for over three years, 66 per cent. had three calves ; whereas of 20 " control cows " (surviving without phosphorus) not one had three calves. The " bone meal cows " produced 87 per cent. of the possible number of calves whereas the control cows produced only 56 per cent. of the possible. The authors consider that on phosphorus deficient veld mineral reserves are exhausted during gestation and lactation, and that two or more barren seasons are required to build up reserves before pregnancy again ensues. If phosphorus is supplied to such cows they again breed with regularity.

(b) Calves born of mothers supplied with phosphorus supplement, i.e. with aphosphorosis rectified or prevented, attain sexual maturity earlier than control cows. In one experiment 84 per cent. of " bone meal heifers " became pregnant when put to the bull at the age of two to two and a half years, whereas only 73 per cent. of the " control heifers " became pregnant.

(c) There is no appreciable difference in the weight at birth between calves born of phosphorus-fed and those born of phosphorus-deficient mothers. Apparently the mother sacrifices herself for the calf and the differences only appear in post-natal life. At the age of weaning the difference between the two sets of calves amounted to 16 per cent. in favour of the bone-meal mothers—the difference being attributed to the larger milk yield (not quality) of the latter. The difference was much accentuated after weaning when the calves had to shift for themselves on the veld. At two and a half years old the superiority

of the calves receiving a bone meal ration was 243 lb. or 33 per cent.—obtained at a cost of ½d. per lb. live-weight.

(d) Growth rates of calves of veld cattle crossed with Sussex, Red Poll, Fries, and Afrikander bulls, are compared. Red Poll grades showed a remarkable growth impetus. The order of response to bone meal was Fries, Afrikander, Sussex, Red Poll [other veld factors involved].

(e) Skeletal development of bone fed animals was superior in every way—length of body, width of chest, height, girth, and width between hook-bones [or femora]. [It may be noted *en passant* that DUERST in his "Grundlagen der Rinderzucht" (Berlin: Julius Springer, 1931.) attaches even more significance to the skeletal measurements than do the authors themselves].

(f) Remarkable results are recorded for the effect of phosphorus supplement upon the incidence of disease—mortality amongst controls 66 per cent. as against only 9 per cent. amongst bone fed (over a period of three and a quarter years), and this despite the fact that the veld was kept reasonably clear of carcass debris in order to reduce incidence of "lamsiekte." The chief causes of death were "lamsiekte," cachexia, fractures, and poisoning (plant poisoning and arsenical poisoning). It is remarkable that losses from poisoning should be reduced by alleviating the osteophagia (or allotriophagia in acute stages) characteristic of aphosphorosis. The general conclusion of the earlier paper by Theiler, Green, and du Toit (24), that cattle would die out on this veld unless rationed with phosphorus compounds, is fully borne out. On the other hand it is shown, more conclusively than before, that grading up of native stock can be economically effected by the simple addition of a small daily ration of bone meal.

In papers 14 and 15, E. M. Robinson reverts to his earlier association with "lamsiekte." He discusses the C and D types of *Clostridium botulinum* as distinct from the A and B types, as compared in agglutination tests and toxin-antitoxin reactions. He regards the *B. parabotulinus* of SEDDON as related to the C type. [responsible for bulbar paralysis, the Australian equivalent of the South African "lamsiekte"—see *J. Comp. Path. & Therap.* **35.** 147-190; 275-280, and *Austr. Vet. J.* **1.** 59.].

The *Cl. parabotulinum equi* of Theiler and Robinson [(1927). *Zeitschr. Infektkr.* **31.** 165-220.] is definitely placed in type D, but the C type also occurs on "lamsiekte farms." "Lamsiekte" is therefore not due to one particular toxin—is just "botulism in the bovine." Marked differences in toxicity for different animal species are, however, shown by the different types.

In paper 15, Robinson discusses botulism in the wider sense—dealing with equines in Pretoria, sheep from the Western Province (compare BEKKER and ROSSOUW.) and birds from the Zoological Gardens. He concludes that botulinus organisms are widely distributed in the soils of South Africa, although curiously enough no cases of botulism in the human subject seem to have been recorded in the Union. The A and B types are probably present but the other incidentals of an outbreak have apparently been avoided. The D and E types described by ROBINSON are stated to be related to the C type of BENGSTON [(1923). *U.S. Public Health Reports.* p. 818.].

In paper 16, Scheuber contributes his observations on the occurrence of the "lamsiekte organism" in the soil of Armoedsvlakte. He demonstrates a toxin-producing anaërobe in soil near decomposing carcasses, in the digestive tract of cattle dead either from "lamsiekte" or any other cause, in the rectum of healthy cattle (7 out of 92 animals in the area), and in guinea pigs from the local hutches [skinned carcasses developed toxicity even when kept in sterile jars, thus indicating *post-mortem* invasion *via* the alimentary tract].

In paper 13, Rossouw appears in the " mineral metabolism series " with a study on sheep. He demonstrates the ready response of inorganic P in the blood to changing levels of phosphorus in the diet (within limits) but finds no change in the lipoid P moiety nor in the organic acid-soluble fraction.

In paper 12, Malan discusses the diagnostic value of low inorganic phosphorus in the blood, in relation to aphosphorosis. In paper 8, he discusses the analytical significance of hydrolysis occurring after precipitation of blood proteins with trichloracetic acid, and comes to the conclusion that sufficiently accurate determinations of inorganic P can be made eight days after precipitation [thus rendering possible a phosphorus survey of large areas, and examination of samples sent by post].

In paper 10, Malan digresses from the main theme and records the phosphorus partition of the blood of various zoological orders. As the title indicates, he takes a variety of animals and determines total phosphorus, lipoid phosphorus, organic acid-soluble phosphorus, inorganic phosphorus, and nucleoprotein phosphorus, in their blood. Data are given for the frog (*Rana esculanta*) snake (puff-adder), fowl (leghorn), pigeon, lactating cow, ostrich, turtle, human being, baboon, goat, horse, mule, donkey, sheep (merino and barbary), llama, kangaroo, dog, cat, rat, rabbit, guinea pig. The total P shows very wide variations, e.g. 224 mg. per 100 c.c. for the pigeon, 128 mg. for the frog, down to 18 mg. for the bovine and ovine. The organic acid soluble fraction ranges from 56 mg. in the pigeon down to 3·5 in the bovine. The inorganic P ranges from 10·7 in the llama down to 1·3 in the pigeon. As would be expected, the nucleoprotein P ranges from very high values in amphibians (frog 57 mg.), reptiles (snake 17 mg.), and birds (fowl 56 mg. and pigeon 135 mg.), all of which have nucleated erythrocytes, down to zero in mammals whose red blood corpuscles are not nucleated. [Traces of nucleoprotein P are of course present in mammalian blood in the leucocytes and the figure may perhaps rise slightly in diseases involving leucocytosis and abnormalities in the character of the erythrocytes].

In paper 11, du Toit, Malan and Rossouw return to animals of economic importance and discuss the rôle of phosphorus in the nutrition of sheep and the production of wool. They show that sheep on a ration extremely low in phosphorus lose weight, and that phosphorus deficiency affects food consumption adversely [compare 33, page 21]. The value of the inorganic P determination in blood is again emphasised since it is shown that the phosphorus intake of sheep is reflected in this moiety. Figures are also given for the calcium content of the blood of sheep.

Paper 4, with Groenewald substituted for Rossouw, takes up the tale. The data show that sheep getting the phosphorus equivalent of 2 lbs. of English hay display good appetite, show a normal value for inorganic phosphorus in blood, and gain well in weight. Sheep receiving the phosphorus equivalent of an estimated daily intake of Bechuanaland pasture show no gain in weight, lose appetite, and display a drop in blood phosphorus. Sheep on low calcium do surprisingly well and big differences in Ca/P ratio do not affect blood calcium. Excess of phosphorus in the diet does no harm. Inorganic P in the blood remains constant on high dietary phosphorus but, within prescribed limits, reduction of dietary P causes rapid change in blood P.

In paper 9, Bekker steps in with Rossouw and shows that in the Bredasdorp district sheep do not get enough phosphorus for physiological requirements, and hence suffer from aphosphorosis. The remarkable occurrence of " lamsiekte " in sheep is recorded and, contrary to previous belief, it is shown that even sheep can manifest osteophagia. Carcass material actually consumed by sheep was found to contain *Clostridium botulinum* (compare 15).

The figure for the inorganic P in the blood of the sheep of this district is less than half that of normal sheep. The carrying capacity of the area is low—about one sheep to five acres. The soil is sandy and infertile. The pasture is poor and shrubs and bushes predominate—with very little grass. Most of the Strandveld farms are owned by farmers who also possess inland farms in the "Rûensveld." This is more fertile (wheat land) and so saves the situation by permitting of periodic transfer from "lamsiekte" Strandveld to healthy Rûensveld. Ewes on the Strandveld rarely come into *æstrum*, and drop very few lambs there. If a farmer only owns Strandveld he makes good his losses by buying year-old lambs from the Rûensveld. Although these do badly from the point of view of thrift and weight they produce a "fine quality" of wool [Bradford grading—a pathological wool which fetches a higher price and to some extent compensates for the poor yield].

Sheep on the Strandveld show skeletal abnormalities but the farmer knows that their bones are fragile, and handle the animals with care. A sheep disease "Lamkruis" (paralysis of the lumbar region) is diagnosed by Bekker, on the description supplied by farmers, as a condition resulting from fracture of the bones of the pelvis. Local small game (duiker and steenbok) are said to suffer from the same disease. A table (p. 295) is given by the authors showing the differences in the character of the bones of sheep from Bredasdorp, as compared with the bones of normal sheep. Although the Ca/P ratio is normal the sp. gr. of the bones is lower and the total weight of comparable bones is much below normal.

In paper 1, the association is between Malan and Bekker. The introduction outlines a programme of work (under the general auspices of DU TOIT) for a mineral survey of pastures by analysis of specimens of blood (of grazing cattle) sent in by field veterinarians.

Samples so obtained are miscellaneous and for adequate interpretation of results it is necessary to have information upon all the factors (age, sex, pregnancy, lactation) which may influence analytical data. In the investigation carried out by Malan as chemist and Bekker as veterinarian, 20 pregnant heifers are studied. The results do not indicate any unequivocal influence of gestation on inorganic P of blood [so that the pregnancy factor will not vitiate biochemical interpretations]. Incidentally, many of the calves showed low inorganic P at birth but this increased rapidly and then ran higher than the corresponding maternal blood for some months [compare Green, H. H., and Macaskill, E. H. (1928), paper 21, p. 389, in which inorganic P of calf blood is recorded as rising sharply during the first week of life and remaining high even after 10 weeks; compare also MEIGS, E. B., BLATHERWICK, N. R., & CARY, C. A. (1919). *J. Biol. Chem.* **37.** 70.].

Papers 5 and 6 of the caption are purely chemical—van der Lingen on points of analytical technique.

Paper 3 by Malan and van der Lingen is a useful assembly of methods which brings determinations of sodium (colorimetric), potassium (titrimetic), calcium (colorimetric), magnesium (colorimetric), phosphorus (colorimetric), and chlorine (titrimetric), in blood and pasture grasses, all within the range of a colorimeter and a burette; so reducing the working time per analysis and increasing the data procurable per individual.

In paper 2, Malan deviates from the phosphorus studies to consider the problematical significance of iodine rationing of poultry.

To an ordinary basal ration potassium iodide was added in appropriate amounts. The absence of effect indicated a sufficiency of iodine in the food stuffs used.

The group of papers as a whole displays the continuity of work characteristic of the Onderstepoort institution and its financial resources, the team spirit between workers professing different subjects, and the promise of further papers in the same series. In the grouping of the contents page in the latest volumes of the Onderstepoort reports, a special section is assigned to " Mineral Deficiency and Metabolism."

H. H. GREEN.

IMMUNITY.

DESPLANQUES, SIMONNET & VERGE. (1931). Recherches sur l'anaphylaxie. Anaphylaxie au sérum. Sur la nature chimique de la substance anaphylactisante. [**Research on Anaphylaxis. Anaphylaxis with Serum. On the Chemical Nature of the Anaphylactic Agent**].—*Ann. Inst. Pasteur.* **47.** 332-338. 1 table. [2 refs.]

These experiments were planned to discover in which fraction of serum the active agent was contained. Both *in vivo* and *in vitro* methods were used, but this report is concerned with the former only.

Normal horse serum was obtained from castrated males and the tests were made on guinea pigs weighing from 300-600 g., a male and a female being used for each test specimen.

To obtain the total albumins, the serum was added gradually to two and a half vols. of purified acetone, both previously cooled to near 0° C. The centrifuged precipitate was carefully, but rapidly, washed with acetone and then with anhydrous ether. The final precipitate, dried *in vacuo* or over anhydrous phosphorus, was a fine white powder. The yield from 100 c.c. serum was 6-7 g.

The globulin was separated from the total albumins by grinding these with distilled water and by adding to 100 c.c. of this solution, sodium chloride 12 g., normal acetic acid 12·6 c.c., normal sodium acetate 12·6 c.c. and, finally, 175 c.c. of 20 per cent. sodium chloride solution. A saturated solution of sodium chloride at pH 4·5 was thus obtained and the globulin was precipitated in this by leaving the mixture for at least 12 hours in the refrigerator. After separation of the globulin by decanting and filtering, the liquid portion containing the serum albumin was dialysed in cellophane bags against iced water until the solution contained about 7·5 parts of chloride per thousand. Both globulin and albumin were obtained in the dry state by reprecipitation with acetone.

Eight male and eight female guinea pigs were sensitised by subcutaneous injection of 0·1 c.c. of serum, previously heated at 56° C. for half an hour ; 20 days later, four animals, two of each sex, were each given 1 c.c. of heated whole serum, four others the total proteins from an equal volume of serum, four the globulins only and four the albumin only. Intracardiac or intravenous injections gave similar results. All animals which received whole serum or total albumins, and three out of four which were given globulin fraction only, died with typical anaphylactic shock. The remaining animal of the globulin series showed typical symptoms and was desensitised. Those which received the albumin fraction only did not show any symptom of shock and were not desensitised, as shown by the result of a further injection of whole serum. The two females of this group had given birth to two young, which were tested with whole serum when a month old, but with negative result.

A. W. STABLEFORTH.

AMAKO, T. H. (1931). Experimentelle Studien über die Agglutinin und Präzipitinbildung. [**Experimental Studies of Agglutinin and Precipitin Production**].—*Zeitschr. Immun. Forsch.* **70.** 400-408. 5 tables. [53 refs.]

From a study of the response to intravenous injection of dead typhoid bacilli, coliform bacilli and staphylococci in rabbits which already had a high titre of normal typhoid antibodies, it is concluded that, although a " heterovaccine " causes antibody formation, it does so to a less degree than an " isovaccine," particularly if not nearly related. A similar difference of response was found in animals which had received a dose of typhoid bacilli a week previously. Typhoid bacilli did not absorb coliform or staphylococcal antibodies or *vice versa*.

Agglutination and precipitation (ring) ran parallel, although agglutination occurred a day or two sooner. Heating to 75° C. prevented agglutination, to 70° C. precipitation. The precipitation antigen was obtained by extraction in distilled water at 60° C. for three quarters of an hour, followed by 24 hours at 37° C. After centrifuging, an equal volume of 1·7 per cent. saline was added.

A. W. STABLEFORTH.

SCHMIDT, S. (1931). Immunisation des chevaux avec les toxines et anatoxines purifiées. [**Immunisation of Horses with Purified Toxins and Anatoxins**]. —*C.R. Soc. Biol. Paris.* **106.** 767-770. [3 refs.]

SCHMIDT, S. (1931). Sur le mode de préparation des toxines et anatoxines diphtériques purifiées et hyperconcentrées. [**On the Method of preparing Purified and Concentrated Diphtheria Toxins and Anatoxins**].—*Ibid.* **107.** 327-329. [1 ref.]

SCHMIDT, S. (1931). Sur la toxicité des toxines additionées d'hydrate d'aluminium de tapioca. [**The Toxicity of Toxins to which Aluminium Hydrate or Tapioca has been added**].—*Ibid.* 330-332. [1 ref.]

Purified diphtheria toxins and anatoxins provoke less inoculation reaction and produce sera of higher antitoxic value than the crude products. To obtain purified diphtheria anatoxin, the author adsorbs the raw toxin with ortho-aluminium hydrate, extracts and elutes with disodium hydrogen phosphate solution, and titrates the product by an *in vivo* test. If the reaction shows toxin to be present, formalin is added and finally the material is dialysed to remove the phosphates and free formalin. From the results of a number of experiments carried out with diphtheria and tetanus toxins, the author concludes that powdered tapioca has little or no effect on the toxicity of diphtheria toxin, but that it has a marked effect in reducing or delaying the toxic action of tetanus toxin. Substituting aluminium hydrate for the tapioca, however, he found this substance to delay the action of diphtheria toxin to such an extent that 10 lethal doses failed to cause a reaction for more than a week after inoculation. It appeared to be probable that the hydrate released the toxin very slowly. With tetanus toxin the action of the aluminium hydrate is less marked.

The immunising power of the treated anatoxins is high, and the author considers that the injection of a diphtheria vaccine containing a large number of purified anatoxin units mixed with aluminium hydrate would be a possible method of rapidly conferring a solid immunity in man by a single inoculation.

NORMAN HOLE.

I. MUTERMILCH, S., & SALAMON, E. (1931). Recherches sur la conservation de la toxine tétanique. [**Investigations on the Preservation of Tetanus Toxin**].—*C.R. Soc. Biol. Paris.* **106.** 63-65. [2 refs.]

II. SCHMIDT, S., & HANSEN, A. (1931). Sur l'adsorption de la toxine et de l'anatoxine tétaniques au moyen de l'hydrate d'aluminium. [**Adsorption of Tetanus Toxin and Anatoxin by means of Aluminium Hydrate**].—*Ibid.* 314-316. [3 refs.]

III. BELIN, N. (1931). Atténuation de la toxine tétanique par le pus d'abces de fixation normal dilué en plasma. [**Attenuation of Tetanus Toxin by Pus from a Normal "Fixation Abscess" diluted in Plasma**].—*Ibid.* 159-161. [3 refs.]

I. Rabbit serum and rabbit tissues, when added as watery extracts in very small amounts to tetanus toxin, preserve its toxic power for at least 415 days under conditions in which untreated toxin would become atoxic in a week. The preservative power of these extracts is diminished or destroyed when they are exposed to a temperature higher than 56° C.

II. By adsorbing with aluminium hydrate, centrifuging, and eluting the deposit with phosphate solution, tetanus toxin and tetanus anatoxin can be concentrated to such an extent that the proportion of toxin or anatoxin to non-specific protein matter is increased. Toxin purified in this way retains the immunological properties of the raw product and, unlike similarly purified diphtheria toxin, its stability remains unchanged. Both flocculation and animal tests with the purified anatoxin have shown that its immunising power is the same as that of the crude material.

III. When mixed with the autolysed products of aseptic pus in physiological saline, or with horse serum or plasma, tetanus toxin obtains a colloid protection enabling it to resist the normal lethal effects of incubation. A mixture of pus and plasma would therefore be expected to be an ideal preserving medium. Converse results are obtained, especially when freshly drawn pus is used. The author considers that this effect is produced because the leucocytes in such pus are alive ; if the leucocytes are killed by incubating the pus-plasma diluent for five days prior to the addition of toxin, the lethal activity is removed. The theory advanced to explain the mechanism of this reaction is that, when mixed with plasma in the presence of toxin, the living leucocytes elaborate antibodies which neutralise the toxicity of the mixture.

NORMAN HOLE.

MAVER, M. E. (1931). **The Chemistry of Diphtheria Toxin produced in Synthetic Mediums.**—*J. Infect. Dis.* **49.** 1-8. 5 tables. [7 refs.]

Although diphtheria toxin has been shown to be a protein or to be closely associated with a protein, studies have been confused by the presence of protein in the culture medium.

The author has adapted two strains of the bacillus to a synthetic medium which is a modification of the Braun-Hofmeier medium. In order to concentrate it, the toxin so made was precipitated by saturation with ammonium sulphate ; it was then dissolved in saline, reprecipitated and dissolved and finally dialysed in Schleicher and Schüll parchment thimbles against running tap water. Alcohol precipitation was not satisfactory.

The dialysed solution was physiologically active and gave positive results by the Millon, biuret, xanthoproteic, ninhydrin, vanillin and glyoxilic acid tests.

Boiling made it cloudy and inactive. Both pepsin, 0·1 per cent. in 0·3 per cent. hydrochloric acid, and trypsin 0·1 per cent. in 0·3 per cent. sodium carbonate, added to equal volumes of toxin solution, destroyed its toxicity. A quantitative chemical analysis for whole protein nitrogen and proteose nitrogen indicated that whole protein and toxin were simultaneously destroyed. Determinations were made by Seibert's modification of Hahn's method. Trypsin in neutral solution was less active. Using whole toxin and the precipitated fraction, it was found by cataphoresis that both the physiologically active part and the protein migrated to the anode at pH 4·05 and to the cathode at pH 3·75. Maximum precipitation occurred at pH 3·97.

It is suggested that conclusive evidence of the protein nature of diphtheria toxin must await the production of a crystalline protein toxin.

A. W. STABLEFORTH.

WONG, D. H., & WONG, A. I. H. (1930). **The Significance of Dysentery Agglutinins in the Colostrum and Milk.**—*Nat. Med. J. China.* **16.** 673-683. 2 charts. 1 table. [19 refs.] [In English].

Specimens of colostrum-milk from 197 human cases were examined for agglutinins against *Bact. shigae*, *Bact. flexneri* and *Bact. flexneri* Y. 154 specimens were from Chinese women ; 83·2 per cent. of them showed agglutinins for at least one of the organisms, the titres ranging from 1 in 40 to 1 in 20,480. Agglutinins were found most frequently for the Y type of Flexner dysentery bacillus and least frequently for the Shiga bacillus. The highest titres were usually obtained within a few days of parturition. Out of 58 cases which possessed agglutinins in the colostrum-milk, 51 or 87·9 per cent. showed a similar qualitative reaction in the blood serum.

Fæces were examined in 105 cases and dysentery bacteria were found in 12. The findings indicated that the agglutinin content of the colostrum is higher than that of the milk and blood serum ; that the strain of child birth may cause the recurrence of dysentery in patients who harbour the bacillus, that 83·2 per cent. of Chinese women coming to the Peiping Union Medical College Hospital have had a dysenteric infection and that some of them are carriers of a dysentery bacillus. The results in the 12 foreign women examined would indicate a lower incidence.

R. LOVELL.

LINDER, G. C., & CARMICHAEL, E. A. (1931). **The Chlorides and Inorganic Constituents of the Serum and Cerebrospinal Fluid in Nephritis and Acidosis.**—*Biochem. J.* **25.** 1090-1094. 2 tables, 1 fig. [8 refs.]

In moderate disturbances of acid-base balance due to nephritis or to ammonium chloride therapy, the normal relationships of the cerebrospinal fluid and arterial blood serum remain unchanged. In severe nephritis with great reduction of serum-bicarbonate and pH and gross nitrogen retention, the cerebrospinal fluid chloride may be considerably higher than would be expected from the serum chloride. In this case, the cerebrospinal fluid bicarbonate is considerably less and its inorganic phosphorus much greater than would have been expected from the corresponding values of the serum. [Only four cases of nephritis were examined and two of ammonium chloride therapy, consequently the results must be accepted with reserve.]

W. R. WOOLDRIDGE.

NICOLAS, E., & BONNAND, O. (1931). Sur l'obtention d'un antisérum floculant les extraits lipoidiques d'organes et précipitant les protéides sériques du Cheval. **[The Production of an Antiserum that flocculates Lipoid Extracts of Organs and precipitates the Serum Proteins of the Horse].**—*C.R. Soc. Biol. Paris.* **106.** 518-521.

It has been shown by CÉSARI that the repeated intravenous injection of sheep red blood corpuscles into rabbits leads to the production of an antiserum that will flocculate a colloidal suspension of lipoid extracted from certain tissues of the horse. In this work, various methods of injecting into rabbits a suspension of sheep erythrocytes in horse serum were tried, and the resulting antiserum was examined, both for its precipitating powers for horse serum and for its flocculating powers for lipoid extracts of horse lung, muscle, etc. It was found that antisera having these precipitating and flocculating powers were produced and it is suggested that, by this means, the presence of horse flesh both in cooked and in uncooked foods can be detected. Few experimental details are given and a preliminary series of results are reported which do not support the final deduction.

W. R. WOOLDRIDGE.

ALSTON, J. M., & STEWART, D. (1931). **Some Observations on Passive Immunity in the Normal Subject Produced by Antipneumococcic Sera.**—*Brit. J. Exp. Path.* **12.** 49-56. 2 tables. [8 refs.]

Six normal, healthy persons were given intravenous injections of different antipneumococcal sera and, at varying intervals afterwards, their blood was tested for its bactericidal effect on types I, II and III pneumococcus, and their serum for its power of protecting mice against lethal doses of the three types. The results indicated that the intravenous injection of concentrated antipneumococcus serum can increase the bactericidal power of the blood and the protective action of the serum against pneumococci homologous to the serum used for as long as 72 hours. Two of the subjects received what was comparable to one fifth of a therapeutic dose of serum and the increase in the bactericidal power of the blood and protective action of serum was negligible compared with that of the other four subjects who received full therapeutic doses. [There is an obvious error in the footnote to Table 2 which is apt to be confusing.]

R. LOVELL.

GRASSET, E. (1931). Sérum anti-typhoidique concentré et purifié. Technique de préparation. Applications cliniques. **[The Preparation of Concentrated and Purified Anti-Typhoid Serum. Its Clinical Applications].**—*C.R. Soc. Biol. Paris.* **106.** 810-812. [2 refs.]

An account of the preparation and clinical applications of a purified polyvalent, antityphoid serum. A mixed emulsion of *Bact. typhosum* and *Bact. paratyphosum* A, B and C, obtained from 48-hour agar growths is heated for 30 minutes at 58° C. and lysed by alternate heating and freezing. Owing to the high toxicity of the product for the horse, it is treated with formaldehyde at 37° C. for one month. After centrifugalisation, an atoxic, but highly antigenic, preparation is obtained which can be used for hyperimmunising horses. By fractional precipitation of the hyperimmune serum with sodium sulphate, the antibody power was shown to be associated with the pseudoglobulin fraction. In this way, a preparation was obtained which was five times as potent as the whole serum.

This latter preparation has been used with great success in the treatment of over 600 cases of typhoid fever. There are no accompanying symptoms of shock, but symptoms of intoxication, delirium, prostration, etc., are observed a few hours after each injection, while there is a marked fall in the temperature and improvement in pulse within 24-36 hours. Three or four intramuscular injections of 20-40 c.c. of concentrated serum usually suffice to overcome the typhoid infection.

W. R. WOOLDRIDGE.

RAMON, G. (1931). Sur l'immunisation antitoxique et la production des antitoxines. [**On Antitoxic Immunisation and the Production of Antitoxins**].—*Ann. Inst. Pasteur.* **47.** 339-357. [13 refs.]

This is a paper showing the value of simple and economic methods as applied to immunisation and antitoxin production. Much of the substance has previously been published by the author in collaboration with DESCOMBEY, with LEMÉTAYER and with ZŒLLER.

Using the flocculation test as a method of antitoxin estimation, the author has studied 40-50 antidiphtheritic sera weekly since 1923. In the course of his observations, he noted a sudden increase in the antitoxic value of sera from certain producers and he found this to be connected with abscess formation at the site of antigenic inoculation. Pursuing this subject, he observed that an aseptic inflammatory œdema had the same augmentary effect on antitoxic value as a septic abscess and, after experimenting with a number of substances, he decided that powdered tapioca or calcium chloride was the most suitable non-specific substance to mix with the antigen in order to set up such an aseptic inflammation. It is not suggested that these substances increase the intrinsic value of the antigen ; their action is a fixative one, delaying the rapid absorption and elimination of the antigen by the blood and allowing a greater time for the antigen-antibody reaction. The author has previously advanced the theory that the antigen, or its derivatives, enters into the constitution of the antibody ; the retention of the antigen in the system therefore enables a greater volume of change to occur.

Applying these principles to methods of practical immunisation, it has been found that two doses of 10 c.c. each of tetanus anatoxin, which will protect a guinea pig against 2-5 fatal doses of toxin, will immunise against 10-50 fatal doses if mixed with powdered tapioca when inoculated. Modified and improved, this method has been utilised to immunise many thousands of horses. In mixing calcium chloride with tetanus anatoxin broth, a deposit of calcium phosphate is formed : this substance adsorbs the anatoxin, and experiment has shown that a mixture allowed to stand for seven months after being heated for one hour at 55° C. is slower in releasing the antigen than when it was freshly mixed and that it provokes a better antibody production. The use of calcium chloride-anatoxin mixtures was found to be a sound practical method of protecting horses.

Associated vaccinations (i.e. the inoculation of a mixture of two antigens) has proved especially satisfactory in human practice, as tapioca sets up a very severe reaction in man. A microbial vaccine, such as T.A.B. (antityphoid-paratyphoid), appears to play a rôle analogous to that of the tapioca, and the use of T.A.B.-antitetanic and T.A.B.-antidiphtheritic inoculations has proved effective for both diseases in adults and in 15-18 months' old children.

It is in antitoxin production that the stimulating value of these non-specific substances is most marked. The use of tapioca in diphtheria antitoxin production has made possible the production of antitoxic sera of very high titre and rapid

hyperimmunisation without loss of health. Another great asset is the apparent power of these non-specific substances to improve a naturally poor producer and to revive the producing power of horses that have been in use for some years. The author describes some experiments which showed that inoculations with antigen treated with tapioca or calcium chloride rejuvenated the antitoxin-producing power of exhausted horses and that the general health of the animals benefited from the injection of the calcium chloride, despite the withdrawal of 14 litres of blood per horse per month. From the theoretical standpoint, these results indicate that the productive power of the horse does not deteriorate and that naturally bad producers can be turned into good producers.

NORMAN HOLE.

WADSWORTH, A., MALTANER, E., & MALTANER, F. (1931). **The Quantitative Determination of the Fixation of Complement by Immune Serum and Antigen.**—*J. Immunol.* **21.** 313-340. 7 tables, 7 figs. [6 refs.]

The authors make an attempt to eliminate some of the inaccuracies which occur in the complement fixation test. They consider the estimation of the activity of complement to be more accurate when estimated at 50 per cent. hæmolysis than at complete hæmolysis. By titration of the hæmolytic activity of complement, it was shown that the course of the reaction was not altered after preliminary incubation of complement, either alone or in the presence of the different reagents of the test. The course of the reaction, however, was altered when complement was titrated without preliminary incubation. Provided that only moderate concentrations of complement were employed, no difference in the course of the reaction was apparent when red cells were sensitised with one, two, four or six units of hæmolysin. The reaction may show some alteration when the concentration of serum constituents is very low or when the actual complement quantities used are considerably increased or diminished.

The constant relationship between the change of activity of a given complement due to the presence of test reagents and the different dilutions of an immune serum made it possible to establish a unit value and, by this means, the authors were able to determine the activity of any dilution of an immune serum with different samples of complement.

R. LOVELL.

SEN, K. C. (1931). **The Sensitisation of Red Blood Corpuscles in Hæmolysis.** —*Biochem. J.* **25.** 1244-1251. 1 table, 6 figs. [11 refs.]

By varying the conditions of the experiments, it was shown that normal serum may act as a hæmolytic agent or may inhibit the lysis of red blood cells sensitised by bile salts. The effect of normal serum is not due solely to the proteins ; the alkali content may have some action as its effect may be imitated by many substances which yield hydroxyl ions in solution. Red cells may also be sensitised towards acids by previous treatment with bile salts or saponin although no sensitisation with saponin can be observed with normal serum. The acceleration of hæmolysis of corpuscles sensitised by bile salts, caused by the addition of serum, acid or alkaline substances, is not only due to changes in the pH, but also to the time allowed for sensitisation.

R. LOVELL.

DOAN, C. A., & MOORE, D. M. (1931). **The Theory of the Mechanism underlying the Phosphatide Precipitin Test in Tuberculosis. With a Study of Two BCG-Vaccinated Children.**—*Stud. Rockefeller Inst. Med. Res.* **78.** 17-30. 3 charts, 1 table, 1 plate. [8 refs.] [Reprinted from *Amer. Rev. Tuberc.* **23.** 409-421.]

The importance of the epithelioid cell in tuberculosis is derived from the relationship it bears to the tubercle bacillus. It is derived from the monocyte of the blood and connective tissues, and an indication of the progression or retrogression of lesions may be afforded by the monocyte-lymphocyte ratio in the blood.

The introduction of the phosphatide fraction A-3 (ANDERSON) into the tissues of normal animals produced epithelioid cells and giant cells, and it would therefore seem that this lipoid may be principally responsible for the new formation of epithelioid tissue.

The intravenous injection of the fraction does not invariably produce a reaction in proportion to the dose. This variation in reaction would appear to be a constitutional factor, as certain constitutions appear to be able to limit tubercle formation and progressive disease under conditions apparently identical with those under which others show no such power of resistance.

To be able to analyse the factors governing the response of the individual to tuberculous infection would be the first step towards a more effective control of the disease. It would seem that the products of metabolism must be promptly eliminated or neutralised if tubercle formation is to be avoided.

The authors have collected data regarding the capacity of certain body fluids to flocculate and precipitate the phosphatide fraction *in vitro*, such fluids having been obtained from animals and human beings suffering from tuberculosis.

A high monocyte-lymphocyte (M/L) ratio implies a cellular reaction (tubercle formation) to phosphatide. The persistence of a low M/L ratio, in the face of injections of phosphatide, indicates either elimination or neutralisation of phosphatide without tubercle formation. Details are given of the observations made on two children vaccinated with BCG. These cases are to be followed up.

A. LESLIE SHEATHER.

MEGRAIL, E., & WELCH, H. (1931). **Antigenic Power of Ultra-Violet Irradiated Tetanus Toxin.**—*Proc. Soc. Exp. Biol. & Med.* **28.** 494-495.

Tetanus toxin was rendered atoxic by exposure to ultraviolet irradiation, precautions being taken to keep the temperature of the toxin below that of the room ; four minutes irradiation sufficed. Nine guinea pigs were each inoculated, first with five subcutaneous injections of this irradiated toxin at intervals of six or seven days and then, after three weeks, with freshly titrated tetanus toxin in doses of from one to ten minimum lethal doses. No signs of tetanus developed. The period of observations was 45 days.

W. R. WOOLDRIDGE.

PUBLIC HEALTH.

——. (1931). **A Discussion on Milk-Borne Streptococcus Epidemics.**—*Proc. Roy. Soc. Med.* **24.** 1703-1712. [23 refs.]

The literature was fully discussed and much new work reported. Reference was made to the recent Hove epidemic and its widespread nature in contrast to

another much smaller outbreak in which contamination of the milk in transit was the probable cause, [WILKINSON]. It was agreed [SAVAGE, MINETT and others] that, although streptococci are extremely common in milk, the vast majority are of one or other of the common bovine types and are harmless to man ; that a number of epidemics of septic sore throat and scarlatina have been traced to actual infection of the cow with types not normally propagated in the bovine udder, but implanted from a human source, and that such streptococci have not infrequently been found unassociated with any human disease. Contamination by streptococci of milk in transit is not a common source of outbreaks ; the magnitude of the outbreaks and their continuous nature alone make this unlikely. Moreover, the growth of streptococci of human origin is inhibited in fresh cow's milk. Further, it has been shown that severe mastitis, accompanied by the excretion of large numbers of organisms, can be set up experimentally by means of a very small number of streptococci and that the condition often continues for weeks or months.

It was shown [MINETT] that the streptococci of scarlatina and of septic sore throat, being hæmolytic, are not likely to be confused with those of the bovine type which are non-hæmolytic. Moreover, they are distinguishable from the common hæmolytic streptococci of bovines by their greater action on red cells, their inability to split hippurate to glycocoll and benzoic acid, their relatively low depression of the pH of lactose broth and their high virulence for mice and rabbits.

It was reported [STABLEFORTH] that human streptococci are sharply distinguished from bovine strains of all types by their antigenic characters, as demonstrable by precipitation and agglutination with immune sera.

The last two speakers also reported the isolation, from severe cases of bovine mastitis, of a number of strains indistinguishable as a group from *S. pyogenes* of direct human origin, but unassociated with any known disease in man.

A. W. STABLEFORTH.

MCINTOSH, J., & WHITBY, L. E. H. (1931). **The Bacteriological Control of Milk-Supplies.**—*Lancet.* **221.** 147-150. 7 tables. [2 refs.]

The author's work has been done in connection with the milk supply of the hospital to which they are attached. They point out that three aspects must be studied :—the economic standpoint, the nutritional value of the milk and its wholesomeness. Standards of cleanliness in milk have been set up and the important points are :—the absence of living tubercle bacilli, the absence of bacteria capable of causing epidemics and a reasonably low bacterial content which will ensure keeping qualities.

Examinations of Grade A, T.T. (tuberculin tested) milk, ordinary milk and pasteurised milk have been carried out. It is stated that, on two or three occasions, Grade A, T.T. milk has been sour before the bottles were opened and that it is not always as pure as the label would imply.

The authors agree with LEDINGHAM that in hospitals, at least, Grade A milk should be pasteurised efficiently before it is distributed. From this it is inferred that the value of Grade A milk is mainly nutritional and that, if an efficiently pasteurised milk of similar value is obtainable, there is no advantage in using the more expensive products.

Regular quantitative analyses of churn milk have been carried out for six years and these have shown that its keeping qualities are practically negligible, particularly during the summer. Biological tests for tubercle bacilli have occasionally proved positive.

The pasteuriser installed in the hospital is worked on the " flash " principle, and by its means a high bacterial count can be reduced to a few thousands per c.c. No tubercle bacilli have ever been detected in samples pasteurised at the hospital and no alteration in the taste or character of the milk has been detected.

Tables are given showing the bacterial counts of milk dealt with at the hospital and of milk pasteurised by the suppliers by means of the " holding " method ; the authors conclude that " flash " pasteurisation is preferable. In either case the pasteurising plant must be very carefully watched and its efficiency checked.

Parallel tests were carried out by the hospital investigators and employees of milk suppliers for the purpose of determining the cause of the great discrepancies in the bacterial counts obtained. These discrepancies were traced to differences in technique and the high counts obtained at the hospital were found to be due mainly to heat-resisting bacteria, the divergence being due to the different culture media used for the plates. The hospital used ordinary agar or litmus-lactose agar made from meat, while the dairy officers used the " lemco " agar advised by the Ministry of Health. The discrepancy in one of the cases given was of the order of 5,000 to 1.

The richer medium gave heavier growths and it also yielded growths which were not found on the Ministry of Health medium. The two main types of these were :—

(a) A gram-negative bacillus which was capable of slow growth at 37° C., but which grew best at 47° to 63° C. The organism possessed no power of fermentation.

(b) A short chain streptococcus which was capable of fermenting lactose, and which resisted heating at 60° C. for an hour.

The dairy companies are aware of the difficulties associated with heat resisting organisms and it is realised that a good many of the troubles from this cause, i.e. the introduction of heat resisting organisms into the plant, originate with the unscrupulous milk producer who, to cover his ineffective methods, heats the milk before sending it to the dairy. Parallel tests of milk as received by the dairy and the same milk after pasteurisation gave the apparently astonishing result of a higher count after treatment than before. The introduction, by the machine, of heat-resistant organisms which were only detected by the richer medium accounted for this result.

The authors conclude that " pasteurisation as generally used at present is not the last word in the provision of clean and wholesome milk " and that closer control of the farmer is essential.

A. LESLIE SHEATHER.

DEMONT, P., & DORNER, W. (1931). La gélose au petit-lait peptoné, milieu de choix pour la détermination du nombre de germes contenus dans de lait. [**Peptonised Whey Agar, the chosen Medium for the Determination of the Number of Bacteria contained in Milk**].—*Le Lait.* **11.** 801-809. 4 tables. [3 refs.]

The authors compared the following nine types of media for the determination of the number of bacteria in milk :—two containing trypsinised ox blood, to one of which was added 1 per cent. lactose ; three containing trypsinised milk diluted with different quantities of tap water ; two with whey as a base and Witte's peptone in concentrations of 0·8 per cent. or 1·6 per cent. ; and two others similar, but with two different kinds of Merck's peptone in a concentration of

0·8 per cent. All the comparisons were carried out against a standard medium containing horse meat broth as a base. The medium of choice was one of the last two containing whey and 0·8 per cent. of Merck's peptone (for bacteriological use). Although it was not superior to the other media, it was both cheap and easily prepared.

R. LOVELL.

BARRIER, G. (1931). A propos de l'abatage rituel. **[Ritual Slaughter of Animals]**.—*Bull. Acad. vét. de France.* **4.** 174-180.

Jews are allowed to slaughter animals by the ritual method in all countries where the Jewish population is considerable : in Switzerland, however, this method of slaughter has been prohibited by the Federal Government since 1892. The campaign recently launched in France by certain societies interested in the protection of animals against the Jewish method of slaughter led the author to put his views on the subject before the " Académie Vétérinaire."

Ritual slaughter as practised by the Jews is vigorously defended on the grounds that it is painless—all movements being reflex—and efficient as it results in very effective bleeding and therefore putrefaction of the meat is retarded. The arguments are based on physiological grounds. It is pointed out that those who protest against this method have made no complaint against the common practice in France of killing sheep and calves by severing the jugular vein without stunning the animals.

D. A. E. C.

VERGE, J. (1931). Les Toxi-infections alimentaires d'origine carnée et l'inspection bactériologique des viandes. **[Combined Toxæmias and Infections in Man due to Ingestion of Contaminated Meat : Bacteriological Examination of Meat]**.—*Rec. Méd. vét.* **107.** 804-851.

This address, one of the series comprised in the " Journées vétérinaires d'Alfort," June, 1931, is confined to that group of organisms responsible for gastro-intestinal disorders in man associated with food-poisoning which produce their deleterious action partly by their presence in the system and partly by the action of their toxins which are usually thermostable. These organisms are considered in two groups, the salmonella and a minor group comprising *B. proteus*, *B. coli*, the enterococcus, etc. The first group receive the greater attention, notably *B. enteritidis* Gaertner, *B. enteritidis* Breslau and *B. suipestifer*.

It is generally recognised that the meat responsible for this type of food poisoning is usually infected *intra-vitam* and that accidental *post-mortem* contamination is comparatively rare. Many outbreaks have been traced to the consumption of the flesh of animals which had died or had been slaughtered during illness although, in some instances, the carcasses have shown no indication of disease.

Recommendations are made as to the steps to be taken in the course of bacteriological examination for the presence of specific organisms, but among the pathological conditions described in carcasses to which outbreaks of this type of disease in man have been attributed, several e.g. pyæmia and septicæmia, would warrant immediate condemnation without resort to bacteriological tests.

D. A. E. C.

THERAPEUTICS.

SOKOLOVITCH, M. (1931). **The Effect of X-ray Therapy on the Partition of Phosphorus Compounds in the Blood in Disease.**—*Brit. J. Exp. Path.* **12.** 147-150.

A paper following up observations by BUCKMAN, DOLAND & WELD [(1925). *Arch. Int. Med.* **35.** 389.] upon the phosphorus content of the blood in chronic myelogenous leukæmia especially as influenced by X-ray treatment.

The author tabulates the phosphorus partition in whole blood, plasma, and corpuscles, in two cases of lymphadenoma, one of hæmangioma, one of carcinoma, and one of cerebral cyst, before X-ray treatment and at intervals of 24 hours to five days thereafter.

He found a decided increase in the lipin phosphorus of the plasma and a fall in the lipin phosphorus of the corpuscles. The changes in ester phosphorus and inorganic phosphorus were not distinctive.

H. H. GREEN.

MORRIS, H., & MARTIN, J. A. (1931). **Santonin as an Anthelmintic for Swine.** —*J. Amer. Vet. Med. Ass.* **78.** 531-538. [1 ref.]

This work was carried out at the Experimental Station of Louisiana State University, expenses being met by the manufacturers and distributors of santonin.

During the period of observation, the experimental pigs were kept in specially constructed crates. Before the drugs were administered each pig was fasted for 24 hours and each pig was killed for *post-mortem* examination five to seven days afterwards. From the results obtained, it appears that, in doses varying from one-sixth grain to ten grains per pound of body weight, santonin caused many of the ascarids to leave the small intestine and to enter the large intestine, about half of those that migrated being still alive. As an accompanying purgative, magnesium sulphate, given in solution through a stomach tube, proved to be better than calomel, because of its more powerful action ; it showed an efficiency of between 90 and 100 per cent. Santonin and beta naphthol, and santonin and castor oil were also tried, but proved inferior to the combination of santonin and magnesium sulphate.

Tests were carried out to compare this combination with oil of chenopodium, carbon tetrachloride and tetrachlorethylene, but unfortunately the pigs which were used proved to be only lightly infected so that the value of the results is not what it might have been. The following are some of the figures obtained :— santonin in doses of two-thirds of a grain per pound of body weight, followed by magnesium sulphate in doses of one grain per pound of body weight, removed 14 out of 15 ascarids from 13 pigs. Oil of chenopodium in doses of 1·5 c.c., followed by 30 c.c. of castor oil, removed three out of six ascarids from 13 pigs. (Symptoms of nausea were observed in six of these animals). Carbon tetrachloride in doses of 4 c.c. diluted with water to 15 c.c., apparently given without a purgative, failed to remove any of the four worms present in 13 pigs. (All these animals showed symptoms of intoxication and one pig died 48 hours after the administration of the dose. On *post-mortem* examination, the digestive tracts of these pigs were found to be highly inflamed). Tetrachlorethylene in doses varying from 2 to 24 c.c., given without a purgative, resulted in the expulsion of three out of five ascarids in 12 pigs.

Even in large doses, santonin appears to be non-irritant to the digestive tract and its efficiency depends upon proper purgation rather than upon the

amount of the drug used. [The anthelmintic action of this drug is less favourably shown in results obtained by other American investigators, notably HALL, SHILLINGER and AUGUSTINE.]

E. L. TAYLOR.

KERSTENS, C. J. A. (1931). De Invlœd van Trypanblauw-Therapie op het vleesch. **[The Influence of Trypan-Blue Therapy upon Meat].**—*Tijdschr. Diergeneesk.* **58.** 695-697.

A short note including a slaughter-house report upon a cow which had been treated five weeks before with a total dosage of 3 g. trypan blue. The colouring matter had not yet disappeared from the tissues. Udder, fascies fat, connective tissue and many serosae and mucosae were stained bluish-green, so that the meat had to be sold on the " Freibank " [miscellaneous market].

H. H. GREEN.

PHYSIOLOGY.

KON, S. K. (1931). **Potato Starch and Refection.**—*J. Hyg.* **31.** 543-549. 1 fig., 1 chart. [14 refs.]

Rats were kept on a diet devoid of the vitamin B complex, but containing raw potato starch. After a preliminary set-back many of the animals were able to live on this diet and some thrived on it for many months without showing any symptoms of vitamin B deficiency, but, when the diet was steamed, the rats rapidly lost condition and died, usually showing obvious signs of vitamin B deficiency. When foods containing vitamin B are similarly steamed, the vitamin is not destroyed and, if other starches replace the potato starch, refection does not occur. From this it is concluded that raw potato starch enables refection to take place in rats and that this synthesis of vitamin B is effected by bacterial action.

W. R. WOOLDRIDGE.

FLOREY, H. (1931). **The Mechanism of Goblet Cell Secretion in the Mammal. The Effects of Cyanide.**—*Brit. J. Exp. Path.* **12.** 301-305. 1 fig., 1 plate. [2 refs.]

This is a continuation of previous investigations in which the histological changes involved in the rapid evacuation of goblet cells were described [see this *Bulletin.* **2.** 26.]. The object of the experiments detailed in this paper was to make a further analysis of the mechanism by which the mucin is rapidly extruded under experimental conditions.

The author concludes that, as proved by the addition of cyanide to the perfusing fluid, oxygen is necessary for the rapid discharge of goblet cells when stimulated. [Cyanide inhibits nearly all cellular oxidation.] He suggests that stimulation (any cause of inflammation) results in a stream of water being passed through the cell and that this dissolves the mucin which is passed out through the open mouth of the cell ; oxygen is necessary for the transport of the water.

J. R. M. INNES.

DAVID, J. Christadoss. (1931). **The Action of Oestrin on the Oxygen Consumption of the Uteri of Mice.**—*J. Pharmacol.* **43.** 1-11. 3 tables, 3 text figs. [20 refs.]

The investigation concerned the normal oxygen consumption of the uterus of the mouse and the changes that occur during the œstrous cycle, after castration and after administration of œstrin.

The whole, or part of the uterus was suspended in a Barcroft apparatus and experiments were conducted at 37° C. in a water bath fitted with a thermostat. Oxygen diffusion in relation to the tissue thickness is discussed ; the uterus of the rabbit is considered unsuitable for purposes of measuring the oxygen consumption, but the uterus of the mouse gives more favourable results.

The average oxygen consumption of the diœstrous uterus of the mouse was about 1·7 to 1·8 c.c. dry gas per gramme moist weight per hour at N.T.P. No definite rise in oxygen was noticed in natural œstrus or when heat was induced in the castrated animal. A definite increase in the oxygen consumption of the uterus occurred in the immature mouse injected with œstrin, the average value obtained being about 2·3 c.c. per gramme per hour. The increase in size of the uterus during œstrus was not due to any great increase in the water content of the uterus.

J. R. M. INNES.

BEST, C. H., & MCHENRY, E. W. (1931). **Histamine.**—*Physiol. Rev.* **11.** 371-478. 1 table. [7 pages of refs.]

This is an excellent review of our knowledge of histamine from every physiological angle, including the response of all tissues and organs to the injection of the amine, the relation of histamine shock to anaphylactic shock and the detoxification of the base by an enzyme, histaminase, present in the tissues. As much of the experimental work discussed by the authors was carried out with dogs and cats, the review has a direct veterinary interest.

W. R. WOOLDRIDGE.

STILL, E. V. (1931). **Secretin.**—*Physiol. Rev.* **11.** 328-357. [214 refs.]

A review of original work on secretin, under the following headings :—history ; source and distribution in the body ; preparation and properties. The original observation of BAYLISS and STARLING [(1902). *J. Physiol.* **28.** 325.] that secretin is a hormone has been abundantly justified and it will probably not be long before it is isolated in a pure state. The existence of prosecretin is still an open question, as is also its suggested cholagogue effect. The property of increasing the tonus rhythm of the gall bladder, however, appears to be definitely due to another substance, " cholecystokinin," and not to secretin. Following on secretin stimulation, the pancreatic juice has a relatively high alkalinity, but the solid and enzyme contents are low, as compared with the juice obtained by vagal stimulation. Purified secretin has no effect upon sugar metabolism, but substances possessing hypoglycæmic properties usually exist with it. Experiments on the reported increase in numbers of both red and white cells in the blood following the injection of duodenal extracts have not yet been repeated with purified secretin. Other results (and suggested functions) obtained by using duodenal extracts are briefly mentioned. No therapeutic use of secretin, *per se*, has yet been shown to be of value.

W. R. WOOLDRIDGE.

TECHNIQUE.

RIMPAU, W. von. (1931). Zur Anaerobenzüchtung. **[Cultivation of Anaërobes].** —*Zlb. Bakt. I* (*Orig.*). **120.** 143. 1 text fig.

Description of an apparatus for the cultivation of anaërobes. It consists of two close-fitting copper hemispheres sealed with a rubber ring. The lower half of this divided sphere is fitted with tripod legs and there is a vacuum cock with pressure gauge in its upper half. The interior space accommodates a rack for six Petri dishes. After insertion of the cultures the apparatus is evacuated and the traces of residual oxygen removed, if so desired, by including a culture such as *B. coli* or a tube of alkaline pyrogallate. The advantages claimed for the apparatus are compactness, cleanliness, unbreakability, and rapidity of evacuation. It can be obtained from F. & M. Lautenschlager, Munich.

H. H. GREEN.

HICKLING, R. (1931). **Vital Staining of Malignant Cells in a Peritoneal Effusion.**—*J. Path. Bact.* **34.** 789-791. 18 figs. on 1 plate. [8 refs.]

The cytology of the peritoneal effusion from a case of sarcoma of the duodenum, peritoneum and mesentery is described. Dried films were stained in the usual way and, in addition, films were made for the examination of the living cells according to the technique of SABIN (1929).

The effusion contained many degenerated neutrophil polymorphs which were unstained and motionless in vital preparations, and also some normal lymphocytes. The remainder of the cells, with the exception of a few phagocytes containing bile pigment, were all of one type and are illustrated in the figures. In the stained films they resembled the monocytes and phagocytes usually found in such effusions ; the nucleoli were well marked and there was a tendency to budding of the nucleus : the cytoplasm contained small vacuoles. The cells were unlike peritoneal endothelial cells. In vital preparations, the cells were motionless and nearly all of them took up the neutral red ; no cells in process of division were observed. The same cells were also observed in films made from the portion of peritoneum removed at operation.

These cells did not correspond with any usually seen in pleural or peritoneal effusions and were considered to be malignant cells from the malignant disease involving the peritoneal cavity.

J. R. M. INNES.

LOISELEUR, J., & VELLUZ, L. (1931). Sur la préparation de membranes cellulosiques renfermant des protides. **[The Preparation of Cellulose Membranes containing Proteins].**—*C.R. Acad. Sci. Paris.* **192.** 43-45. [1 ref.]

VELLUZ, L., & LOISELEUR, J. (1931). Sur les propriétés des membranes protéo-cellulosiques. **[The Properties of Proteo-Cellulose Membranes].**—*Ibid.* 306-308. [2 refs.]

In the first paper a method is described for the preparation of membranes composed of an intimate mixture of proteins and cellulose. Solutions of cellulose in acetic acid are mixed with solutions of proteins (egg albumin, gliadin, serum proteins, etc), in anhydrous formic acid and, from the resulting homogeneous mixture, membranes may be made in the ordinary way ; if gelatin is used as the

protein, it is dissolved in glacial acetic acid. The membranes obtained on drying may be transparent or opalescent, according to the concentrations of the cellulose and proteins used, and their permeability varies with the conditions of evaporation.

In the second paper, it is shown that, in mixed membranes, each constituent exerts its own properties. The cellulose makes the membrane insoluble in water and imparts a rigidity to it ; hence its rôle is essentially static : the proteins impart more active properties ; various colour reactions can be demonstrated and it can be shown that salts, such as those of silver and gold, are readily adsorbed on the membrane, but are dispersed evenly over the whole surface. The properties of the membranes vary to some extent with the cellulose : protein ratio and, when the concentration of protein is less than 10 per cent., it is usually impossible to demonstrate protein properties. In conclusion, it is suggested that these artificial, mixed membranes closely resemble natural membranes.

W. R. WOOLDRIDGE.

NEUMANN-KLEINPAUL, K. (1931). Neukla Augenlupe. [**A New Opthalmoscopic Apparatus**].—*Arch. wiss. prakt. Tierhlk.* **64.** 235. 1 fig.

Describes a new instrument designed for use when it is desired to inspect an eye by stronger illumination than is obtainable with the standard type of ophthalmoscope.

This instrument, which was designed by the author and is made by Hauptner, Berlin, consists of a battery in a case on the top of which is mounted a large biconvex lens and a small searchlight. The latter is set at the angle required to illuminate the field visible through the lens : the shape of the illuminated area can be either circular or elliptical.

J. T. E.

JONES, T. R. (1931). **A Method of Injection of the Blood Vessels of Animals.**—*Austral. Vet. J.* **7.** 103-104.

The author recommends the following procedure for increasing the visibility of the smaller blood vessels in cadavers prepared for dissection.

The animal is killed and bled as rapidly as possible and a hot solution consisting of two parts of formalin, one part of crude glycerin and seven parts of water is introduced into the opened carotid artery under a pressure of 10 feet of gravity. After some minutes a froth of the solution appears at the nostrils and the injection is continued for as long again as it took to produce this effect. The animal is then held to be properly preserved.

Immediately after this perfusion is finished a second solution is introduced by the same channel ; this is composed of two pounds of glue, one drachm of trypan blue and one gallon of water and it is pumped in while hot.

The formalin already injected precipitates the trypan blue and prevents its escape through the walls of the arterioles so that the arterial system stands out in sharp contrast to the other tissues.

Animals so prepared should not be dissected until after the lapse of a week or more.

A small horse requires about ten litres of the formalin-glycerine-water solution, a sheep or goat half a litre and a dog of average size 250 c.c.

J. T. E.

HALL, M. C. (1931). **Address of the President.** [American Veterinary Medical Association.]—*J. Amer. Vet. Med. Ass.* **79.** 432-460.

As President of the American Veterinary Medical Association, Dr. HALL has set himself the task of formulating a policy for the future direction of this active veterinary association. During his tour of office, this project has been discussed in short articles and editorials in the veterinary press and at State Veterinary meetings in various parts of the country.

The presidential address, which was made on his retirement at the annual general meeting of the Association, is a complete statement of the policy ; he discusses, mainly in principle, but also in some detail, the best ways and means of advancing the Association in its many different spheres of activity and of hastening the progress of Veterinary Science.

The address is divided into seven sections and 26 subsections comprising some 12,000 words in this author's well-known, clear, literary style. The range of the matter which is discussed may be gathered from the seven sectional headings, which are as follows :—General Matters ; Colleges ; Practitioners ; Army ; Federal Bureau of Animal Industry and the Dominion Health of Animals Branch ; Commercial Houses and the A.V.M.A.

As stated by the author, this programme does not only represent his own ideas, but is, rather, a collection of the opinions—some of which have been ably stated and discussed in the past—of many men in different fields of veterinary work spread over the whole of the United States.

If advance in scientific and professional matters is to proceed at a maximum rate, it is of fundamental importance to have a set programme and, although some of the ideas set forth in this address will be too advanced for immediate acceptance, they are worthy of the serious consideration of all progressive members of the profession.

E. L. TAYLOR.

MISCELLANEOUS.

MONOD, T. (1931). Le Vétérinaire colonial. [**The Veterinarian in Colonial Services**].—*Rec. Méd. vét.* **107.** 942-958.

An address given in the course of the " Journées vétérinaires d'Alfort " in June, 1931. An account is given of the organisation of the Veterinary Services in French Morocco.

D. A. E. CABOT.